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SECTION III.

REPORT ON THE

REPTILES AND AMPHIBIANS,
OF OHIO.

BY W. H. SMITH, M. D., PH.D.

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LETTER OF TRANSMISSAL.

Professor J. S. NEWBERRY, Chief Geologist :

DEAR SIR: I have the honor herewith to transmit the following synoptical and descriptive catalogue of the Reptiles and Amphibians of Ohio.

While the aim has been to make this a fair presentation of the fauna of the State, it has also been an object to render the facts pertaining to these animals as accessible as possible to persons desiring to gain information. The data upon which this catalogue is founded are not only the collections received from Ohio but also the works of previous writers on Herpetology, the results of whose researches have often been employed.

Under the head of habitat is given the range of each animal outside of the State, so far as specimens present would admit, or as was found recorded in the writings of some competent authority. Whenever there was a reasonable degree of doubt as to an animal occurring in a region it has been indicated by an interrogation or quotation mark; and though in other cases there might be the best of reasons for believing the range of the animal more extensive than here given, in the absence of a recorded observation or specimen it has not been indicated.

While it is hoped that the lists here given will prove reasonably complete, it is undoubtedly true that a more careful survey of the State by one versed in Herpetology would add other and very desirable facts to the results herein contained. To enable any one using this synopsis to recognize species not now recorded from Ohio in case they occur there, as well as to render this catalogue more valuable for comparison with neighboring States, various references to, as well as lists of, extralimital species occurring nearest to our limits are given. It is also hoped that the references to other authors may prove an aid to at least some students of Herpetology.

Finally, the writer takes pleasure in rendering acknowledgements first of all, to Prof. Tuttle, of the Ohio State University, who generously placed a fine set of Reptiles collected in the State at his disposal. Considering that he and Prof. Tuttle had never met, but were entire strangers, and that the latter gentlemen could have been actuated solely by a desire to aid science, his action is worthy of high commendation. The collection thus forwarded to the writer was of value in that it contained two specimens which otherwise he would not have been able to locate in the State. The author also received a like generous treatment from Oberlin College and Michigan University, both of which institutions place their entire collections at his disposal. He is also under obligations to the various authors who have written upon this subject, but without attempting to enumerate them in detail he will simply say that among the best of these may be mentioned Baird and Girard's excellent Catalogue of N. A. Serpents,

Agassiz's Contributions to Natural History, Dumeril and Bibron's Erpetologie, the Catalogues of the British Museum, DeKay's Reptiles of New York, Prof. Cope's Check List, and Mitchell's Researches upon Crotalus Poisoning. With this acknowledgement of obligation and with gratitude for all favors received.

I am, sir, very respectfully yours,

W. H. SMITH.

ST. CLAIR, MICH., *April*, 13, 1881.

REPORT

ON THE

REPTILES AND AMPHIBIANS OF OHIO.

BY W. H. SMITH, M. D., PH. D.

INTRODUCTION.

There are in the State at least thirty-six species of Reptiles and twenty-five Amphibians. That vulgar prejudice exists against many of these animals, which leads to their being killed wherever met, is a common place truth. To show how ill-founded is this prejudice it is only necessary to say that there are probably in the State but three animals, *Crotalus durissus*, Banded Rattlesnake, *Crotalophorus tergeminus*, Massassauga, and *Ancistrodon contortrix*, the Copperhead, which are at all venomous. The remainder are perfectly harmless.

However, these creatures do not simply fail of doing evil. They often do positive good. Thus the office of such animals as frogs, salamanders, lizards and some snakes, in devouring noxious insects and other vermin, is a very important one, and has a direct bearing upon the agricultural interests of the State. It remains then a question whether farmers will continue to misunderstand and destroy these true friends of theirs or whether they shall be protected.

The food of some of these animals furnishes an interesting object for study. Thus the common Bull Frog, *Rana catesbiana*, has been known to eat insects, helices, worms, mice, spiders preserved in alcohol, and even their own species. Two instances of this came under my personal observation. In one case having placed two frogs in a jar over night I was surprised in the morning to find the smaller one, which was about one-third the size of the other, had disappeared. To avoid the possibility of mistake, the remaining one was killed, opened, and the other found in his stomach in a semi-digested state. In the other case a large frog was seen in the

very act of swallowing one about half his own size. I have subsequently seen snakes in the stomachs of other snakes, salamanders in other salamanders, and it may be an interesting question as to how far this cannibalistic habit obtains throughout the animal kingdom.

In the stomach of this same species, Allen* found a *Chrysemis picta* or Painted Tortoise, one and a half inches long, and saw it seize a cedar bird which he had shot, and which the frog proceeded to swallow, although the wings and tail projected from its mouth, and there it sat waiting quietly for the lower end to digest. The same gentlemen, as well as Dr. Brewer,† states that they have seen it swallow young ducks, and it is a common belief of Massachusetts farmers that it robs them of their young chickens. The story by Dr. Jones‡ of finding a grass snake in the stomach of a large bull frog is so remarkable that we may reasonably hesitate about accepting it until confirmed by other observers.

Other frogs probably use similar food; in fact, the writer has observed the *Rana halerina* or Leopard Frog in the act of swallowing its own species, and has found the elytra of beetles in their stomachs. And as these animals, as well as toads, lizards, salamanders, and some snakes subsist chiefly upon insects, they aid in keeping down the multiplicity of these pests, and are thus beneficial.

The tadpoles or young of frogs, and probably also of salamanders live almost, or entirely, upon vegetable matter. However, in some cases they are said to have eaten decomposing animal matter, and even other tadpoles. Prof. Baird states that this may be taken advantage of to clean skeletons by placing the two together in water. The larval *Rana sylvatica* he found to be the most effective, as these devoured the macerated flesh, leaving a ligamentous skeleton. Their food primarily is vegetable, and it is probable that they never attack their own species unless driven by hunger or after they have attained a good degree of development.

The frog is, usually at least, very cautious in regard to its method of taking food. It ordinarily approaches and first touches the prey with its tongue, then retires and afterwards returning with a spring, seizes, holds, and manipulates it dextrously with the fingers of its anterior feet, then closes its eyes, and forces the animal head foremost downwards into the stomach. During this operation, if interrupted, it jerks and kicks vigorously so long as the intruder continues its annoyance.

The toad is a voracious feeder. It has been observed to eat nine wasps, one after the other, but would take no more. The same afternoon it

* Proc. Boston Soc. Nat. Hist., Vol. 12, pp. 185-197.

† Proc. Boston Soc. Nat. Hist., Vol. 5, p. 211.

‡ Chemical and Physical Investigations, Smithsonian Contributions, Vol. 8.

greedily devoured eight additional ones. It eats worms and insects of every kind, but prefers bees and wasps. It will not touch a dead animal, even though just killed, but waits for its prey to stir before seizing it. On taking bees and wasps, instead of swallowing them immediately, it presses them between its jaws until death occurs, and thus avoids their sting.

When an insect drops before a toad at rest, the latter immediately arouses from its torpor, and with animation moves towards its prey. It halts, pointer-like, at a proper distance, and finally with lightning-like swiftness darts out its tongue and brings the animal into its mouth. A miss of its mark is not followed by a second attempt until the insect begins to move.

As these animals hibernate, are cold blooded and sluggish, they can go for a long time without food. Hallowell kept a *Proteus anguinus* thirteen months without nourishment, and, so far as observed, the animal suffered no inconvenience. And yet there is a limitation to their powers of endurance. The stories so often repeated about finding them immured in rocks cannot be sustained; in all these cases probably some cavity, by which they had entered when small, and through which they continued to receive air and food, had probably been overlooked. At all events it has been experimentally proved that toads cannot live twelve months when deprived of air, nor two years without food.

In regard to the tailed Amphibians, they are all insectivorous, *Spelerpes porphyriticus* having been observed in the very act of eating flies, while the contents of the stomach in others leaves no doubt as to their diet. Thus, in *Notophthalmus viridescens* or Crimson Triton was found insects, spiders, physa, and lymnea; in *Plethodon erythronotus* were small mollusks; while in *Spelerpes ruber* or Red Salamander occurred worms, elytra of beetles, and the remains of other salamanders. In like manner *Salamandra maculosa* has been shown to eat flies, beetles, young snails, and worms. *Menobanchus lateralis* undoubtedly feeds upon Annelids and Libellula larvae, while *Menopoma alleghaniensis*, the Alleghany Hellbender eats worms, fish, crawfish, and the like.

Lizards are insectivorous, though as to their additional articles of diet the writer as yet has no information.

Turtles undoubtedly vary in their food. *Cistudo clausa* has been seen to eat insects and an Agaric or mushroom; the Green and Gopher Turtles are vegetarian, the latter being fond of sweet potatoes, melons, and bulbous roots, and injuring gardens; *Chrysemys picta*, the Painted Turtle, and *Nanemys guttatus*, the Spotted Tortoise, eat worms, insects, frogs, aquatic reptiles, and probably also the water plantain; *Chelydra serpentina*,

the Snapping Turtle, preys upon frogs, fishes, and young ducks ; while *Trionyx ferox* is said to feed upon fish and small aquatic reptiles.

Serpents vary full as much as turtles in regard to food. For instance *Liopeltis vernalis*, the Green Snake, is insectivorous ; *Diadophis punctatus* the Ring-necked Snake, eats worms, insects, and grubs ; *Storeria dekayi*, the Little Brown Snake, has been found with the elytra of beetles in its stomach ; *Eutænia sirtalis* feeds upon frogs, toads, and small quadrupeds ; *Abastor erythrogrammus* takes rats ; *Bascanion flagelliforme*, the Coach-whip Snake, preys upon birds ; *Boa Constrictors* and *Pythons* swallow their species ; *Ancistrodon contortrix*, the Copperhead, eats mice, Ranidæ, and small birds ; *Pityophis melanoleucus* takes mice, rats, rabbits, and young chickens ; *Ophibolus triangulus* uses frogs and toads ; *Bascanion constrictor*, the Blue Racer, consumes frogs, small birds, and other snakes, having been observed swallowing a dead *Eutænia* ; while in the stomach of *Tropidonotus sipedon*, the Water Snake, I have found frogs and small fishes, and in *Ophibolus getulus*, the Chain Snake, the remains of other serpents ; *Crotalus durissus*, the Rattlesnake, is said to live upon insects, frogs, lizards, mice, moles, young birds, and chickens. Toads are ordinarily believed to be eaten by serpents. However, the writer's experience, having in vain endeavored to feed them to *Bascanion constrictor* and *Crotalophorus tergeminus*, leads him to believe that toads are rarely preyed upon by snakes, but that they are sometimes eaten by *Eutænia sirtalis* and *Ophibolus triangulus* is, it appears, beyond question. The former he has himself seen in the act of swallowing a *Bufo americanus*.

The fangs of the venomous serpents* are firmly soldered to the lower side of the maxillary bone, which joins the lachrymal above by a ginglymoid articulation. Posteriorly it is in contact with the external pterygoid and palate bones. A muscle, the spheno-ptyergoid, which has no analogue in other animals, extends from the base of the cranium in the middle line, backward and outward, to be inserted into the external pterygoid, which by contraction it draws forward, pushing the maxillary before it and causing the fangs to be erected. At the same time, other muscles cause the mouth to be widely opened and the anterior portion of the body to be thrown forward, downward, or backward toward the object aimed at. If the enemy is missed, the venom may spirt several feet, but if struck, another pair of muscles, the external pterygoid, which run from the point of articulation of the lower jaw forwards, and are spread out as a fascial layer over the gland, and inserted by two slips

*For a fuller treatise upon *Crotalus* poisoning, its venom and antidotes, see the excellent article by Dr. S. Wier Mitchell, Smithsonian Cont., vol. xii, to which the author is largely indebted for facts here given.

into the base of the fang, contract, drawing the point of the latter backward, thus deepening the wound, and in part forcing out the venom. This is followed by still another motion or rather two other movements, a rolling outward of the two upper maxillary bones and with them the fang, so that if the animal misses its aim it may not bite itself, and the closure of the mouth. The latter is effected by various muscles, among which the anterior temporal lies over the posterior two-thirds of the poison sac, and in contracting, forcibly compresses the glands and compels the venom to flow out through the duct and tooth into the wound. That the duct does not enter the tooth is true, but the sheath falling at the base completes the channel, though in rare cases not perfectly, but permits the fluid to escape alongside the fang. After having thus struck its victim, deepened the wound, and injected a sufficient quantity of venom, the animal opens its mouth and lets go its hold. Occasionally it happens that the teeth of the lower jaws become entangled, and the serpent is unable to get away. It will then shake its head from side to side, not as is ordinarily supposed on account of rage, but in its efforts to escape. At times, also, only one of the fangs penetrates the wound, and the victim receives only half the usual amount of venom. In such a case, or in case the venom was spilled outside the fang, or the serpent's supply was exhausted by its having previously bitten an enemy, a physician might be seriously misled as to the effects of a remedy.

In structure, as Prof. Owen* has shown, the fang may be likened unto a simple tooth, flattened and then turned up so as to bring the edges together, thus forming a cylinder or rather a cone open at both ends. The suture is along the anterior or convex side of the tooth, thus bringing the veniferous canal in front of the pulp cavity. The venom is secreted by the glands, and the only cavities for its storage are the ducts, hence the terms poison sacs, vesicles, etc., are misnomers, and ought be abolished.

The average amount of venom thrown out at once by a serpent, three or four feet long, is from two to four drops, though in some cases as much as fifteen drops has been given off through a single fang. By filling the glands with water their capacity has been estimated at from eleven to twenty-nine drops. The color of the venom varies from pale green to orange; its specific gravity is from 10.30 to 10.44; it is tasteless, acid, dries slowly, and is then adhesive, and its virulence is not affected by heat or cold. Heat, however, produces an albuminous precipitate which is harm-

*Comp. Anatomy, Vol. I, p. 396.

less, and if, after filtration, alcohol be added to the liquid part another precipitate will be obtained, containing all its virulent property. The material to which its virulence is due is, therefore, not precipitated by heat, but is by alcohol, and yet this re-agent does not render it inert, as has been shown by injecting the alcoholic precipitate under the skin of animals.

In the treatment of venomous snake bites it is obvious that any means taken to prevent the poison gaining full egress into the system must be very serviceable. Thus, if the bitten part be a limb, a ligature above the wound will interrupt the circulation and exclude a large portion of the venom. For a similar purpose, scarifying or sucking the wound, or burning it with caustics may be of service. However, any such means to be available must be used speedily after the injury, and their value lessens as we recede from that period. As the venom is supposed to operate by depressing the heart and inducing putrefactive changes in the blood, muscles, and other parts of the system, it is evident that stimulants are always indicated, and in fact, alcohol in some of its forms is among the best remedies; also bathing the wound in ammonia, and ammonia and arsenic internally given, are said to have excellent antidotal effects.

After all, the danger from serpent bites, though serious, is not so bad as is generally believed. In the first place, they are of rare occurrence, and it is only exceptionally that we know of a person who has met with such an accident; and then in the second place, it is exceptional for a person bitten by a venomous serpent to die. The rule is for them to get well. In Dr. Mitchell's sixteen cases there were only four deaths, and this is a fair average mortality. The danger, of course, varies with the amount of poison injected, and the surgical means used to prevent its complete passage into the system. The belief that hogs are not injured can probably be explained on the ground that the virulent matter is absorbed by the adipose tissue and does not enter the circulation.

The question of the virulence of the venom upon the serpent itself has been settled by experiment, and also by Dr. Dearing's* case of a *Crotalus* that accidentally bit himself. The result was the death of the snake. Thus we see that the venom exerts its deadly power, not only upon cold and warm-blooded vertebrates, but upon the animal which produces it. In other words, it is a liquid secreted from the blood, which becomes fatal on being introduced back into the very same source.

Another interesting fact in regard to these animals, to which, I believe,

*Proc. Boston Soc. Nat. Hist., vol. iv, p. 313.

attention has not hitherto been properly directed, is the various modes of protection furnished them by nature. We find the Turtles, for the most part, provided with a union of the cuticle and skeleton into which they can retreat, and which can be closed about them. To see the value of this mode of protection, it is but necessary to endeavor to draw out the head of one, which will be found to be a very difficult task. In a similar manner, the scales, plates, and spines, so common as a dermal covering, have a profound significance, and their color is a matter of too great a value to be overlooked. The Rattlesnakes and Copperheads are provided with fangs, for injecting venom, and the former with a caudal rattle, by the vibration of which it may aid in frightening away its foes. But the color has an important bearing. The young of the venomous *Crotalophorus tergeminus*, and of the harmless *Tropidonotus virgatus* and *Ophibolus triangulus*, bear such a resemblance to each other that it might be considered a case of mimicry. However, the color of these animals is more or less adapted to their surroundings. The Green Snake resembles closely the grass through which it crawls, and the same is true also of the *Storerias* and Striped Snakes. Unless closely examined they could easily escape the eye of the observer. In like manner the markings of frogs furnishes an excellent illustration of adaptation. The green of the Bull-frog and the spots on the Leopard Frog need but be mentioned to be appreciated. *Rana temporaria* var. *sylvatica*, when pursued, conceals itself in grass or leaves, which it resembles so closely as to be discovered with difficulty. The Common American Toad (*Bufo americanus*), might not at first seem to have its colors most suitable for protection, and yet when we see it in its secluded retreats, under stones and in odd corners, and consider its nocturnal habits, the conviction forces itself upon me, that probably no better shades could have been chosen. As desert animals are sand colored, and arctic are white, like the snow, so these animals show a decided adaptation to their surroundings.

The best illustration is furnished by the common Tree Toad (*Hyla versicolor*). Like the Chameleon, this little animal can change its color and thus transform itself into a being resembling the limb or branch on which it sits. As Milne Edwards* found in the Chameleon, so in this there are two sets of cutaneous glands, the one superficial and the other deep. The former of these gives it a green coloration, with a golden reflection; the latter are much thicker and dark. They contain many brush-shaped cavities, and the expansion of these towards the circumference determines the color and causes the green tint to disappear, not

*Ann. des Sci. Nat., 1834, p. 46.

only by diminishing its cavities but by expanding its own. In this manner the deep meshes sometimes appear white while the exterior network takes on a pearly aspect. The animal in this manner, by blending in a different degree two or three primitive colors, changes its shade so much that it comes to resemble the object upon which it happens to be. A similar power to vary these colors at will is present to a greater or less extent in all the Hylidæ. The advantages of this, in enabling these animals to escape their enemies, and to approach their prey unobserved, is too obvious to be considered here.

In this connection it may be mentioned, that tadpoles sometimes show a mimetic coloring. A case of this kind is recorded by Miss Monk,* in which, being kept in an aquarium with Water Purslane, *Ludwigia palustris*, they imitated almost precisely the color of the leaves. So perfect was the resemblance that a friend visiting her was actually deceived and mistook a leaf for a tadpole. Personally I have seen such cases of imitation, but none sufficiently marked to justify a person being misled in this manner.

Again, the serpents have a remarkable power of enlarging their bodies by the inhalation of air. To understand how this is done it is but necessary to dissect a snake, and observe the situation and length of the lungs. By thus enlarging his body the serpent renders himself more formidable in appearance, and has thus a tendency to frighten away an enemy. Add to this the peculiar blowing sound with which the air is emitted, sometimes as in *Heterodon*, suggesting the rattle of the *Crotalidæ*, and again, as in *Pityophis*, said to imitate the roaring of a bull, and this matter of exhalation, as well as inhalation, has a profound significance.

Another mode of protection is in the secretion of some of these animals. Thus the frog on being caught usually ejects a quantity of fluid, and also becomes more or less swollen. The use of this ejection was to me a mystery until seeing Mr. Aldrick's† account of a snake gliding upon a frog, when the latter simultaneously jumped and threw this liquid into the mouth and eyes of the serpent. The latter was apparently blinded by the discharge, sprung wildly from side to side, and lost track of his intended prey. This incident seems to indicate that the ejection of this fluid in the frog accomplishes the same purposes as the discharges in the Bombardier Beetles, and enables the Batrachian to escape its enemies.

However this may be, the cutaneous secretions of some Reptiles, and Amphibians are admirably adapted to the purpose of protection.

*Am. Naturalist, vol. xii, p. 695.

†Am. Naturalist, vol. xii, p. 473.

The Musk Tortoise, Serpents, Tree and Common Toad are illustrations of this. No person has ever handled the Common Garter Snake alive without finding his hands for sometime afterwards tainted with a very disgusting odor. Rattlesnakes, on sufficient irritation, have been known to emit a yellow or brownish fluid, and a very offensive smell. In like manner the consequences of annoying the Spreading Adder are very unpleasant to one's olfactory organs. Also, *Pityophis* is said to emit an odor equally disagreeable, and the Tree Frogs have an acrid excretion.

According to Rainey's* experiments the secretions of the Common Toad are irritating, acrid, and capable of producing a smarting sensation like aconite. Dr. Blick's account of the half drunken man, who, in a wager, bit off the head of a toad, and paid for his experiment by an alarming swelling of lips, tongue, and throat, and Dumeril and Bibron's† observation that the emanations from these animals seemed to have an ill-effect upon others when confined together with them, with the fact that a dog will not touch a toad, render it probable that they secrete a matter by the glands on their exterior, which is very important to them as a means of protection. While this is true, the common belief that handling them is productive of warts or other deleterious effects is utterly without foundation, and has its counterpart in the belief of the common people of Great Britain, that if a person afflicted with warts handles a toad it will effect a cure. There is, however, according to Escobar‡ a South American toad, *Phyllobates melanorhina*, which secretes a venom of so great virulence that it is extracted and used by the Indians for poisoning their arrows. This venom is sufficient to effect the death of large animals, like the Jaguar, and is equally fatal to man, exerting its toxic effect by acting upon the organs of sensibility and motion.

The ordinary course of development is for Frogs and Toads, when about to deposit their eggs, to seek the water of some pond, ditch, or brook, and there they pair, the eggs being fecundated as they are emitted. The young when hatched are gill breathing animals, and hence incapable of existing without water. However, the young sometimes appear in cellars and gardens with high walls, which, as Lowe, Jenyns,|| and

* Micros. Journ., London, 1858, p. 457.

† Erpetologie Generale, Suite a Buffon, Tome 8, p. 184.

‡ Comptes Rendus, Tome 68, p. 1488.

|| Ann. and Mag. Nat. Hist., 1853, pp. 341 and 463.

Bennett* observe, can hardly be explained on the supposition that they had passed through the larval state. It is probable, therefore, that as the *Salamandra atra*, which lives high up the Alps, is ovoviviparous, and *Hylas martinicensis*, of Guadaloupe, † comes forth mature from the egg, so our Amphibians, in part at least, under certain circumstances, bring forth their young in a perfect condition.

Again, physical agents exert an important influence upon the developments of the animals. Thus the larvæ if kept in too deep water will not develop. They grow, but continue in the tadpole state, unless the liquid be shallow. Temperature also plays an important part, it having been found that at 60° F. the ova of frogs will develop most rapidly, and any diminution of temperature is followed by a corresponding retardation of development. The effect of light is rather a mooted question, and yet it is probable, from the experiments of Edwards, Higginbottom ‡ and Thury,|| that its presence hastens and its absence retards their progress; the latter showing that in a green jar, with other conditions equal, tadpoles would not develop, while they did in one constructed of ordinary glass, thus rendering this conclusion highly probable.

Some very recent interesting experiments are recorded on the *Salamandra atra*, an ovoviviparous animal, by Madame von Chauvin.§ It was believed that if the young were removed prematurely from the mother and placed in water they would adapt themselves to an aquatic life. The experiment proved entirely successful, in that one individual lost its gills, developed a new pair suited to respiration, and, after fourteen weeks residence in water, underwent transformation and became a land Salamander. This would seem to indicate, that, at some not very distant day, the *Salamandra atra* and *maculosa* had diverged from a common stock, and that while one continued on in its aquatic mode of reproduction, the other had, owing to changed conditions, become terrestrial.

As regards the geographical distribution of Reptiles, much might be written, but a few facts will only be referred to here. That these animals, like the birds, increase in beauty and variety of markings, and in their venomous properties as they approach the tropics, is an old observa-

* Proc. Am. Ass. for Adv. Sci., 1853, p. 230.

† Am. Naturalist, vol. viii, p. 438.

‡ Ann. and Mag. Nat. Hist., 3d Ser., vol. 15, p. 376.

|| Ibidem, 4th Ser., vol. 15, p. 376. See also Proc. Acad. Nat. Sci., 1867, p. 169.

§ Am. Naturalist, vol. xii, p. 468.

tion. Another important factor, to which Prof. Cope* has directed attention, is the amount of terrestrial and atmospheric moisture. In the Amphibians, which spend nearly or all their life in water, and the aquatic turtles and serpents, the dependence of the species upon this element for distribution is sufficiently manifest. The well-watered eastern border and the Mississippi Valley are the homes of the aquatic Reptilian and Amphibian life, while the dry and almost barren region from Mexico to Arizona and Nevada is characterized by the predominance of Lizards, Toads, and Snakes with an extraordinary development of the rostral shield. The latter characteristic, seen in our Hog-nose Snake, probably is in some way useful to the animal in removing the sand in which it either burrows for concealment or seeks for food. A peculiar foot structure, or movable spines on the side of the leg, may find a similar explanation, while the prolongation of the nostrils forward in our *Trionychidæ*, or Soft-shelled Turtles, is a character adapted to their habits of life, they living buried in mud, and only bringing this proboscis to the surface to accomplish the work of respiration.

In a similar manner may be traced a relation between the powers of endurance of these animals and the extent of their distribution. Thus Amphibians will endure more cold than the Ophidians, and hence extend farther northward. In the writer's, and, so far as his knowledge goes, other's efforts to keep serpents over the winter, they, if once frozen stiff, invariably failed to resuscitate, but a frog, even when taken out of the ice and gradually thawed, comes forth to an apparently new life. The modes of progression, serpents being limbless, the scarcity or abundance of food, the enemies of a species, and the method of reproduction, have important bearings. It cannot be expected that snakes which propagate only when several years old, oviposit usually in the hotter parts of summer, and then lay only a few eggs, should compete with the more enduring frogs and toads, which have such a numerous progeny. Owing to such causes one would expect what is actually found to be the case, that the Amphibians are far more abundantly distributed over the earth than are the Ophidians.

In the Western Continent, Dr. Günther has shown that we have two apparently distinct creations, the one radiating from the Valley of the Amazon; the other from that of the Mississippi. That these faunas meet and mingle along Northern Mexico, Western Texas, Arizona, and Nevada, is a fact abundantly attested. To these might perhaps be added the mixed life of the Pacific region, and that radiating from the Mississippi

*Proc. Am. Ass. Adv. Sci., 1875, B p. 127.

Valley, as first pointed out by Agassiz for Turtles, and afterwards divided by Cope, into an Eastern, Southern, and Western fauna.

Finally, in regard to classification, the study of these animals has been rendered needlessly complicated. Naturalists have seemed so eager to append their names to a new species that, instead of examining to see what others had done before them, they affixed a new name to a large per cent. at least, of the animals met. The truth of this statement is evident from the abundant synonymy by which nearly all these animals are known. In some cases again, the most careful and conscientious observers have been misled, and considered varietal differences specific characteristics. Such a principle followed out in regard to the human race would give us numerous species of men founded on as valid grounds as have been many of the species of animals. Moreover, in regard to the separation of these animals into genera, families, sub-orders, etc., naturalists have changed each others names and arrangement, often for better, but too many times apparently for the sake simply of a change, and to the disadvantage of science.

In selecting marks of species, families, and orders, much difficulty must be experienced. To any one who has made a careful and thoughtful study of osteological characters, these, though among the best, are insufficient. Thus the bones of the same animal vary, not only in the extent of ossification, but in number with age. Nor are the anatomical relations of the soft parts any more valid. Let a person examine the structure of a frog and tadpole, and he would unquestionably pronounce them to be distinct species. On the other hand the teeth, their shape, presence or absence, the matter of having a grooved or hollow poison fang, indicate a habit of the animal, and are, to a certain extent at least, valuable grounds of classification. The same remark will apply to the presence or absence of a tongue in the Amphibians, its shape and attachments, and whether protrusible or not, so as to become an instrument of prehension. In a similar manner the palmation of the toes indicating an aquatic animal, and the dilatation of the tips showing an arboreal habit, the projecting rostral in *Heterodon*, the soft shell and prolonged nostrils in the *Trionychidæ*, the presence of parotoids, the granulation of the abdomen, the covering of the head, the scales whether carinate or not, the presence of spines or thorns, and femoral pores, as well as the transverse lamellæ seen on the feet of *Anolis*, seem to be tolerably constant and consequently valuable in classification. These should be combined with osteological and other characters carefully used, and also taken with a diligent study of the animal's habits, and thus in time we may hope to get a valuable and permanent arrangement. Until such a redistribution can be made,

the following classifications of Dumeril and Bibron of Ophidia and Lacertilia, and Günther of Anoura, and Agassiz, as modified by Cope, of Testudinata, are perhaps the best attainable.

That many of the marks used in describing species in this treatise are not constant, the writer and every student of Herpetology well knows. Thus the presence and absence of a loreal or ante-orbital plate may both be seen in the same animal on opposite sides of the head; the number of rows of dorsal scales varies in different individuals of a species; the coloration and arrangements of the spots and stripes, the number of the upper and lower labials, in fact the cephalic plates are liable to become more or less fused and run together; the number and arrangement of the shields in the carapax, and even the shape of the head is more or less variable. In using such marks, for the purposes of description, the writer but acknowledges the imperfections of this branch of Zoology, and hopes that after this suggestion, no one will be misled by any of these variable characters at times used in the synopses, but that they may be found of service in the identification and study of the species.

One of the most difficult things about the study of these animals is that their colors change so much when placed in alcohol. Thus yellow becomes white; green, blue; and red, brownish-black; while brown and metallic tints remain for some time unchanged. However, exposure to the sun for a season will often enable us to form an idea of the original shade.

Sex may be told in most if not all Turtles by the males having convex plastra, and in the Anoura by the males, in the greater portion of the species, being supplied with vocal vesicles.

REPTILIA.

Vertebrate animals characterized by having the blood cold with oval nucleated corpuscles; heart usually with three chambers; circulation incomplete; venous and arterial blood intermingled; aortic arches two, which coalesce or anastomose in front of the dorsal vertebræ; reproduction oviparous or ovoviviparous; embryo with amnion and allantois; respiration pulmonary in young and adult; lungs with few cells; metamorphoses none; occipital condyles one; rami of the lower jaw in several pieces; os quadratum present; nervous system cerebro-spinal; brain small; lateral lobes of cerebellum, corpus callosum, and pons varolii wanting; corpora bigemina upon the upper surface of the brain; epidermal covering in the form of scales or plates. Excrementitious and reproductive organs opening into a cloaca.

Exclusive of the extinct orders, the following synopsis will refer an animal to its proper place:

KEY TO THE ORDERS OF REPTILES.

Epidermal covering in the form of plates, not united with the skeleton; anal slit longitudinal; teeth conical, in sockets. CROCODILIA.

Epidermal covering united with the skeleton forming a carapax and plastron; teeth none. TESTUDINATA.

Epidermal covering in the form of scales, rarely plates, distinct from the skeleton; anal slit transverse; teeth conical. a.

a. Eyelids usually present; mouth not dilatable; body usually lacertiloid with four well developed feet. LACERTILIA.

a. Eyelids none; mouth very dilatable; body always serpentiform, without feet; abdomen usually covered with large, entire, transverse scutellæ.

OPHIDIA.

CROCODILIA. (Extralimal.)

Body lacertiloid, of large size; dermal armor composed of scutes and overlapping scales; *anal slit longitudinal*; limbs four, well developed, anterior pair shorter, posterior feet more or less palmate; fingers five, toes four; nails on the three preaxial digits usually present; eyelids three, distinct; auditory openings with valves; external nares capable of closure; teeth in a single row, in sockets; tongue thick, fleshy, adherent its entire length, and not protrusible; heart quadrilocular, but with the pulmonary artery and aorta connecting; quadrate bone large; palatines excluding the vomer from the

orbit; parietal foramen none; alisphenoids large; orbitosphenoid rudimentary or wanting; vertebræ completely ossified, procœlous except atlas, dentatus, the two sacra and first caudal; in extinct species amphi- or opisthocœlous; cervical vertebræ with small ribs; ribs articulating with the vertebræ by means of a head and tubercle; always oviparous.

Inhabit fresh water in hot countries.

The Crocodilians are all extra-limital. The existing forms may be divided as follows:

Muzzle large and flat. *a.*

Muzzle elongated, rounded and dilated at the end. GAVIALIDÆ.

a. Fourth tooth in lower jaw received into a notch on the side of the upper maxillary; hind legs with a toothed fringe, and toes completely palmated.

CROCODILIDÆ.

a. Fourth or canine tooth in lower jaw received into a fossa in the upper; hind legs simply rounded and toes semipalmate. ALLIGATORIDÆ.

Gavialidæ, the Gavials, comprise two genera, *Gavialis*, one species, *G. gangeticus*, inhabiting the Ganges, and *Somistoma*, two species, in the rivers of Borneo and North Australia.

Crocodilidæ, the Crocodiles, has one genus, *Crocodilus*, with four American, three African, four Asiatic, and one Australian species. On this continent they are not found north of Yucatan, Guatemala, or Cuba, except one species, *Crocodilus americanus*, which occurs in Florida.

Alligatoridæ, the Alligators or Caimans, comprise also but a single genus, *Alligator*, with ten species, and are limited to the New World.

Alligator mississippiensis or *lucius* is the common Alligator of our Southern States. It is dark ash-brown above, paler beneath; dorsal plates with elevations forming disconnected longitudinal ridges; four of these carinate plates upon the neck are arranged quadrately.

CHARACTERS OF REPTILIANS.

	Ophidia.	Testudinata.	Lacertilia.	Crocodylia.
Covering.	Scales.	Carapax and Plastron.	Corneous scales.	Scales and bony plates.
Body.	Serpentiform.	Short and thick.	Lacertiloid or serpentiform.	Lacertiloid.
Limbs.	None.	Four, flexible.	Four, rarely none.	Four.
Teeth.	Not in sockets.	None.	Not in sockets.	In sockets.
Heart.	Trilocular.	Trilocular.	Trilocular.	Quadrilocular.
Pectoral and pelvic arches.	None.	Within ribs.	Outside of ribs or none.	Outside of ribs.
Eyelids.	None.	Present.	Present.	Present.
Rami of the lower jaw.	Unanchylosed.	Anchylosed.	Anchylosed.	
Urinary bladder.	None.	Large.	Present.	
Orbitosphenoid.	Wanting.	Wanting.	Rudimentary or wanting.	Rudimentary or wanting.
Alisphenoid.	Wanting.	Wanting.	Rudimentary or wanting.	Large.
Anal slit.	Transverse.	Nearly circular.	Transverse.	Longitudinal.

ORDER LACERTILIA. LIZARDS.

Sauria, MIVART, MILNE EDWARDS.

Body usually lacertiloid, in some species serpentiform: *feet usually four*, sometimes two, and occasionally none; *anal slit transverse*; body covered with scales, tubercles, or spines; top of head with plates; eyelids usually movable; teeth conical, not in sockets; heart with auricles and a ventricle, the septum in the latter incomplete; urinary bladder present; vertebrae procoelous except in the Geckos and *Sphenodon* where they are amphicoelous; sacrae separate, sometimes one, and never exceeding two in number; head of ribs simple, undivided; sternum present except in the serpentiform species; quadrate bone somewhat movable; rami of the lower maxillary usually firmly united; alisphenoids and orbitosphenoids absent or rudimentary; parietal foramen usually distinct; parotic processes long; hyoid a median rod.

The Lacertilia comprise a large order, with numerous species and families. Those inhabiting North America may be arranged as follows:

- * Bones of skull grown together; dorsal region covered with square plates; generative organs simple; feet rudimentary or none. AMPHISBAENIDÆ.
- * Bones of skull distinct; dorsal region usually scaly; penis and vagina bifid; feet usually well developed. *a.*
 - a.* Tongue flat, elongate and bifid. *b.*
 - a.* Tongue thick, convex, attached at base to œsophagus. *c.*
 - b.* Abdominal region covered with roundish scales, quincuncially arranged and resembling those of the back. *d.*
 - b.* Abdominal region covered with square plates. *e.*
 - c.* Dorsal scales granular; eyes large, almost without lids. GECKOTIDÆ.
 - c.* Dorsal scales imbricated; eyes moderate; lids distinct. IGUANIDÆ.
 - d.* Eyes and eyelids nearly or quite concealed. *f.*
 - d.* Eyes and eyelids prominent. SCINCIDÆ.
 - e.* Teeth solid; cephalic shields large. *g.*
 - e.* Teeth hollow or grooved behind. *h.*
 - f.* Head conical; rostral cup-shaped. TYPHLINIDÆ.
 - f.* Head depressed; rostral elongated. TYPHLOPSIDÆ.
 - g.* Sides flattened, without lateral fold. *h.*
 - g.* Longitudinal lateral fold or stripe present. *i.*
 - h.* Cephalic shields small. HELODERMIDÆ.
 - h.* Cephalic shields large, regular. *l.*
 - i.* Ear distinct. *j.*
 - i.* Ear concealed. CHALCIDÆ.
 - j.* Limbs two or none; body serpentiform; no femoral pores. ANGUIDÆ.
 - j.* Limbs four; body more or less lacertiloid. ZONURIDÆ.
 - l.* Supraorbital plate bony. LACERTIDÆ.
 - l.* Supraorbital plate horny. TEIDÆ.

Of these families, Amphisbaenidæ has one genus *Rhineura*, with one species, *floridana*, inhabiting Florida; Geckotidæ has four, *Coleonyx*, *Sphaerodactylus*, *Phyllodactylus*, and *Diplodactylus*, of which *Sphaerodactylus notatus* occurs in Florida, the remainder range from Texas to the Pacific coast; Typhlinidæ has *Aniella pulchra* in California; Typhlopsidæ, one genus, *Stenostoma*, with two species ranging from Texas to the Pacific; Teidæ has *Cnemidophorus* and *Verticaria*; Helodermidæ has *Heloderma horridum* in Mexico;

Lacertidæ has *Xantusia viridis* in California; Chalcidæ has *Brachypus curieri* in British Columbia; Anguidæ, one species, *Ophisaurus ventralis*; Zonuridæ, two genera, *Gerrhonotus* and *Parisisa*, the former with six, the latter with a single species, *olivacea*, which range from Texas to California. None of the preceding families occur in the State, but the Iguanidæ and Scincidæ are represented in our limits.

FAMILY SCINCIDÆ. THE SKINKS.

Body lacertiloid; dorsal and ventral region covered with similar imbricated scales, quincuncially arranged; head subtriangular, tapering gradually into the neck; back rounded, without crest or spines; tongue fleshy, squamous, flat, emarginate, and free anteriorly; cephalic plates present; nostril opening into a solitary nasal; prefrontal single; temporal fossa arched; premaxillaries two; mesosternum cruciform; feet four, well developed.

* Supranasals none; lower eyelid with a transparent disk. LYGOSOMA.

* Supranasals a pair; lower eyelid scaly. EUMECES.

GENUS EUMECES. Wiegmann.

Head short, approximately cuneiform; nasal plates one on each side, just behind the rostral; a small pair of supranasals just above; superciliaries above each eye four; occipitals five; post-frontals two; vertical pentagonal; teeth in both jaws in a marginal row; anterior margin of ear dentate; both eyelids scaly; scales smooth and imbricated; toes five on each foot, distinct and provided with claws; tail long, conical, and covered with scales similar to the body.

EUMECES QUINQUELINEATUS Linnæus.

Blue-tailed Skink.

Lacerta fasciata, LINNÆUS, SHAW, LATREILLE.

Lacerta quinque-lineata, LINNÆUS, GMELIN, GREEN, SAY.

Scincus tristatus, DAUDIN.

Scincus quinque-lineatus, SCHNEIDER, LATREILLE, DAUDIN, KÜHL, MERREM, HARLAN, SCHLEGEL.

Scincus bicolor, HARLAN, CUVIER.

Euprepis tristatus, WAGLER.

Tiliqua bicolor, GRAY.

Scincus fasciatus, HOLBROOK, STORER, DEKAY.

Plestiodon quinque-lineatus, DUMERIL and BIBRON, GUNTHER.

Color bluish-black above with five yellow lines, the vertebral one of which bifurcates on the head, giving off a branch to the right, and another to the left side of the vertical plate; both branches extend to the nostrils where they unite with the nearest lateral lines; the lower lateral line passes from the snout through the auditory opening just above the limbs to the tail; all these lines become indistinct on the caudal extremity, and all disappear with age; abdomen light-bluish; extremities brownish above, bluish or light colored beneath; throat and gular region creamy white; tail deep blue; toes long, anteriorly the second and third of equal length, and posteriorly the second the longest; nostrils small and situated near the muzzle; scales of the body and limbs imbricated, and plates on the head well developed; supranasals and post-frontals

not contiguous. Length, $7\frac{1}{2}$ inches; fore limbs, 1; head to axilla, $1\frac{1}{4}$; body, from muzzle to anus, 3; hind limbs, $1\frac{3}{8}$; tail, $4\frac{1}{4}$; diameter of head, $\frac{5}{8}$; diameter of body, $\frac{1}{2}$.

Habitat, Massachusetts, New York, to Georgia, Florida, and Mississippi, north to Ohio, Michigan, and Illinois.

In the young the yellow stripes are very distinct, and disappear with age, as well as other marks of coloration, which, taken with a slight variation in the cephalic plates, would lead one to suspect a distinct species. The female also probably differs from the male by the retention of the characteristics of the young longer, it may be to an adult state. The blue color of its tail may be due to its having been broken off and reproduced, but it is probably its natural tint.

The Blue-tailed Skink is found under bark in May; it is very active in its movements and difficult to capture. It lays nine oval eggs at a time; is occasionally seen sunning itself, and when alarmed makes a rapid retreat.

GENUS LYGOSOMA. Gray.

Head sub-quadrangular; palate edentulous; nasals nearly contiguous; supranasals wanting; rostral erect, triangular; lower eyelid with a transparent disk in the center; body fusiform; scales smooth; external auditory meatus distinct.

LYGOSOMA LATERALE Say.

Ground Lizard.

Scincus lateralis, SAY, HOLBROOK, GRAY, KIRTLAND, DUMERIL and BIBRON.

Scincus unicolor, HARLIN.

Oligosoma laterale, COPE, JORDAN.

Mocosa lateralis, GUNTHER.

Lygosoma laterale, DEKAY, BAIRD.

General color olivaceous with black dots, and a dark stripe margined with white on each side; abdomen and under parts yellowish; tail blue, twice the length of the body; ear very large, circular, the anterior edge simple and rounded; prefrontal plate very long, narrowed anteriorly; post-frontals double; two preanal scales largest. Length, 6 to 8 inches.

Habitat, Florida. Georgia. South Carolina and Texas to "Illinois and Ohio."

This species I find mentioned in Dr. Kirtland's report as having been sent to him by Mr. Dorfeuille, and said to have been taken in Ohio. I have not seen it from the State.

Breeds in Georgia in the middle of March.

FAMILY IGUANIDÆ. THE IGUANAS.

Body lacertiloid or raniform; scales imbricated, usually not in whorls; ventral region covered with small plates or scales; cephalic plates various or irregular; tongue papillose, simple, thick, fleshy, convex, emarginate, and slightly free anteriorly, but not

protrusible; maxillary teeth sometimes in a common alveolus, and sometimes soldered to the jaw; gular region often provided with a pouch; back sometimes crested; feet four, with distinct toes; premaxillary bone single; mesosternum anchor-shaped.

The *Iguanidæ* are all extralimital except *Sceeloporus*, but the following synopsis of those inhabiting North America may be of service in referring the animals to their appropriate genera:

Dorsal scales carinated; infraorbital plate long. *a*.

Dorsal scales smooth or tuberculated; nape without spine. *c*.

Dorsal region and nape more or less spinose; body raniform. *b*.

a. Cephalic plates smooth; occipital as broad as long. SCELOPORUS.

a. Cephalic plates rugose; occipital much longer than broad. HALOTREPIS.

b. External ear opening present. PHRYNOSOMA.

b. External ear opening none. DOLIOSAURUS.

c. Infraorbital region with one long plate. *d*.

c. Infraorbital region with row of short plates or scales; occipital small. *i*.

d. Interorbital plates in two rows. AMA.

d. Interorbitals in one or three series. *e*.

e. Occipital the largest of the cephalic plates. *f*.

e. Occipital plates no larger than the others. *h*.

f. Caudal scales smooth; anterior limbs very long. *g*.

f. Caudal scales above carinate; anterior limbs moderate. UTA.

g. Ear distinct. CALLISAURUS.

g. Ear invisible. HOLBROOKIA.

h. Rostral plate triangular; a row of scales like a crest extending along the back from nape to tip of tail. DIPSAURUS.

h. Rostral oblong; no trace of a dorsal crest. CROTAPHYTUS.

i. Toes enlarged under the antepenultimate phalanges forming a suboval, transversely lamellate space. ANOLIS.

i. Toes not thus enlarged. *j*.

j. Tail blunt; rostral plate transversely oblong. EUPHRYNE.

j. Tail pointed; rostral small, scale-like. CROTAPHYTUS.

GENUS SCELOPORUS. Wiegmann.

Head short; cephalic plates smooth, the occipital largest; a row of moderately large plates begins on each side of the occipitals, passes forwards, and between the orbits becomes a single row, which is bounded on each side by a very small row; superciliary region with one row of large plates; eyelids scaly; infraorbital plate long, sometimes with smaller ones at the end; internasal region with small irregular plates; inframaxillary plates small; external auditory meatus very distinct; nape without spines; gular pouch not marked; dorsal scales carinated, ventral smooth, imbricated; tail long and pointed; caudal and dorsal crests wanting; toes on each foot five, unguiculate; femoral region with a series of distinct pores.

SCELOPORUS UNDULATUS Harlan.

The Brown Swift.

Lacerta undulata, DAUDIN.

Uromastix undulata, MERREM.

Lacerata hyacinthina, et faciat, GREEN.

Agama undulata, HARLAN.

Tropidolepis undulatus, CUVIER, HOLBROOK, GRAY, DUMERIL and BIBRON, DEKAY, STORER.

Sceloporus undulatus, GRAVENHORST, BAIRD, COPE, JORDAN.

General color above brownish, with irregular transverse undulating bands of black; gular region and sides greenish blue; abdomen and under surface of limbs and tail greenish to yellowish with dark spots; toes whitish; rostral plate depressed, making a triangle of slight altitude; nasals large; skin upon the throat thrown into a partial fold; dorsal scales imbricated, with the carinae on their posterior portion not denticulated; thighs behind the femoral pores covered with small scales; tail and toes long and slender. Length, 6 inches; head to gular fold, 3 lines; head to anus, $2\frac{1}{2}$ inches; fore limb, $\frac{1}{2}$; hind limb, $1\frac{1}{2}$; transverse diameter of head $\frac{1}{2}$ inch; of neck, $\frac{1}{2}$ inch; vertical of head, $5\frac{1}{2}$ lines; circumference of body, 2 to 3 inches.

Habits. Connecticut, New York, Pennsylvania, Ohio, Illinois, Arkansas to Georgia and the Gulf of Mexico.

Extraordinary North American Lacertilia, whose range is such as to render their occurrence in Ohio possible.

ANGUIDÆ.

Ophisaurus ventralis, Daud.

HOLBROOK, N. A. Herp., ii, p. 135.—GUNTHER, Cat. Liz. Brit. Mus., p. 56.—Proc. Acad. Nat. Sci., Phila., 1856, p. 239.

Habits, Virginia, Georgia, Florida, Alabama, Mississippi, Louisiana, Tennessee, and Kansas. "Michigan".

TEIDÆ.

Cnemidophorus sexlineatus, Linn.

Proc. Acad. Nat. Sci. Phil., 1854, p. 192.—HOLBROOK, N. A. Herp., ii, p. 109.—GUNTHER, Cat. Liz. Brit. Mus., p. 21.—U. S. Geolog. Surv., 100 Meridian, v., p. 557.

Habits, Virginia, Florida, Illinois, New Mexico, Mexico, Arizona, Nevada, and Utah.

SCINCIDÆ.

Eumeces septentrionalis, Bd.

Proc. Acad. Nat. Sci. Phila., 1858, p. 256.

Habitat, Minnesota, Nebraska.

Eumeces anthracinus, Bd.

Jour. Acad. Nat. Sci. Phila., 1850, p. 294.

Habitat, Pennsylvania to Texas, in mountains.

Eumeces inornatus, Bd.

Proc. Acad. Nat. Sci. Phil., 1858, p. 256.

Habitat, Nebraska.

IGUANIDÆ.

Anolis principalis, Linn.

HOLBROOK, N. A. Herp., ii, p. 77.—GUNTHER, Cat. Liz. Brit. Mus., p. 202.—Proc. Acad. Nat. Sci. Phila., 1856, p. 232.

Habitat, South Carolina, Florida, to Louisiana and Texas. "Cuba."

The Brown Swift, known also as *Pine tree Lizard*, and *Brown Scorpion*, is a very active little animal; it prefers sandy and rocky soils, especially regions of pine forests; and, though harmless when disturbed, elevates its scales so as to give to its body a more formidable appearance. It may be seen on sunny days on fences and the sides of houses, and apparently does not occur in wet places. It probably hybernates beneath old bark; does not become adult until two years of age; and in Georgia breeds in April.

ORDER TESTUDINATA. TURTLES.*

Chelonia, GRAY, MIVART, HUXLEY, and MILNE EDWARDS.

Body-covering in the form of a dorsal and ventral shield; carapax and plastron formed by a union of the epidermis and skeleton; head, neck, feet, and tail free; jaws in the form of a horny beak, edentulous; tongue thick and fleshy; rami of lower mandible ankylosed; bones of the cranium immovably united; alisphenoid unossified; nasothmoid cartilage present; premaxillæ small and united; quadrate bone large, immovable; caudal vertebrae procelous; sacral vertebrae two; thoracic walls immovable; legs four, with the pectoral and pelvic arches inside the skeleton; lungs voluminous, with exceedingly large cells; heart with two auricles and a ventricle, the latter with an imperfect septum; urinary bladder large.

KEY TO THE FAMILIES OF TESTUDINATA.

- * Limbs in the form of paddles. CHELONIDÆ.
- * Feet palmate; usually fluviatile. *a*.
- * Feet clavate; terrestrial; carapax very convex. TESTUDINIDÆ.
 - a*. Carapax composed of hard osseous plates. *b*.
 - a*. Carapax leathery, without osseous plates. TRIONYCHIDÆ.
 - b*. Sternal shields 12 or more. *c*.
 - b*. Sternal shields less than 12. CINOSTERNIDÆ.
 - c*. Jaws usually not strongly hooked; plastron oval or oblong. *d*.
 - c*. Jaws strongly hooked; plastron cruciform. CHELYDRIDÆ.
 - d*. Plastron with a movable transverse suture; carapax short and high.
 - CISTUDINIDÆ.
 - d*. Plastron usually without such suture; carapax depressed or elongated.
 - EMYDIDÆ.

* For classification and reproduction, see Agassiz's *Conc. Nat. Hist. U. S.* and also *Proc. Zool. Soc. London*, 1869, p. 165.

Family *Chelonidæ*, extralimital, Atlantic and Pacific coasts, is easily recognized by its limbs being in the form of flappers; plastron somewhat cruciform; the vertebral costal plates each often with a prominent scale or tuberos projection. It has four genera, *Chelonia*, two species, Agassiz's Cont., i, p. 377, and Holbrook's N. Am. Herp., ii, p. 25; DeKay's Rept., p. 2; *Thalassochelys*, one species, *caouana*, Holbrook's Herp., ii, p. 33; Agassiz's Cont., i, p. 384; *Eretmochelys*, two species, Agassiz's Cont., i, p. 380, and Holbrook's Herp., ii, p. 39; and *Sphargis*, one species, *coriacea*, Storer's Rep., p. 216; Holbrook's Herp., ii, p. 45, and Agassiz's Cont. i, p. 317.

Testudinidæ, extralimital, has carapax short and very convex; plastron with a somewhat movable transverse hinge; limbs clavate; claws blunt and short, and toes firmly united by the integument; one genus *Testudo*, three species, *agassizii*, Proc. Cal. Acad. Sci., 1870, p. 67; *carolina*, Agassiz's Cont. i, p. 447; Holbrook's Herp., p. 25; and *berlandieri*, Agassiz's Cont. Nat. Hist., i, p. 447.

FAMILY CISTUDINIDÆ. BOX TORTOISES.

Carapax and dorsal disk of bones consolidated completely, the shell thus formed being short, high, and broad; sternal bones united with the epidermis to form a plastron with a transverse movable suture; sternal shields twelve, the gular, post-gular, and pectoral in front of the suture, the abdominal, preanal, and anal behind; plastron and carapax united by a ligamentous articulation; jaws somewhat hooked; feet slightly palmate; claws moderate; tail very short; head and neck long.

GENUS CISTUDO. Fleming.

Plastron rounded or truncate anteriorly and posteriorly; lobes unequal, the forward one shorter; hind feet elongated; toes unequal, the second longest; scales of the feet subequal, rounded posteriorly.

CISTUDO CLAUSA Gmelin.

Common Box Turtle or Checkered Tortoise.

Cistudo carolina, KIRTLAND, STORER, DEKAY.

Cistudo virginea, *el triunguis*, AGASSIZ.

Cistudo virginea, ALLEN.

General color of carapax black, variegated with yellow, sometimes the conditions give rise to well defined spots, bands or blotches; upper part of head and neck brown, often mingled with red or yellow especially upon the sides; gular and inframaxillary region varying from a speckling or spotting of black and white to a uniform reddish-yellow; plastron varying from black spotted to a uniform reddish or yellowish; carapax notched in front; marginal plates twenty-four or twenty-five; costals four on each side; last vertebral rounded superiorly, the first pentagonal, projecting in front, often notched behind as are the second and third, all the plates with concentric striae; young with a median dorsal keel; second and third costals nearly quadrilateral; hind toes three or four. Length of carapax, 6 inches; height of carapax, 3 inches; tail from anus, 4 lines.

This species has been confounded with the *Testudo carolina*, a southern animal, which probably does not extend north of the Carolinas. They differ in the feet of the latter being club-shaped, with only the blunt claws projecting, while our Turtle has its feet

somewhat palmate with sharp pointed claws. The color markings being very variable are of no value as furnishing points of distinction.

Habitat, Massachusetts, New York, Ohio and Michigan, to Missouri, and South.

This species is rare, but occurs in every part of the State. Their favorite resorts are dry sandy hills, being rarely found in damp places. They cannot endure rain, but retire to their holes on the approach of a storm. They attain a great age, a specimen mentioned by Allen* must have been at least sixty years old. They probably do not migrate to any great distance from their birth-place, and go into winter quarters by burrowing into the ground in September.

FAMILY CHELYDRIDÆ. SNAPPING TURTLES.

Head and neck large and powerful; jaws strong, horny, the apex of upper with a distinct downward curve; tail long, with a caudal crest of prominent, laterally compressed tubercles; feet palmate with long claws; plastron small, cruciform, composed of twelve shields; aquatic animals of great strength and exceeding ferocity.

† Head covered with plates; a row of three scales on each side between the costal and marginal plates; extralimital. † MACROCHELYS.

† Head covered with skin. CHELYDRA.

GENUS CHELYDRA. Schweigger.

Head large, but smaller than in *Macrochelys*, and covered with soft skin; upper and hinder part of the orbit projecting beyond the skull; mouth very broad; commissure sinuous; nostrils large; tympanum often concealed; carapax highest medially with ridges on the vertebral and costal plates, which disappear with age; under side of tail with two rows of large, smooth scales; no scales between the costal and marginal rows of plates

CHELYDRA SERPENTINA Linnæus.

Snapping Turtle.

Testudo serpentina, LINNÆUS, DAUDIN, LECONTE.

Chelonura serpentina, SAY, HOLBROOK, KIRTLAND, DEKAY.

Emys serpentina, GRAY, MERREM.

Emysaurus serpentina, STORER, DUMERIL and BIBRON.

Chelydra serpentina, GRAY, COPE, ALLEN, JORDON.

Color olivaceous or dirty brown above; plastron, under part of legs, neck, and tail yellow, becoming dull with age; color more or less disguised by the mud adherent to the animal and carapax; vertebral shields nearly quadrate, the first with a rounded, sinuous or jagged edge behind; last neural pointed posteriorly; second and third

* Proc. Bost. Soc. Nat. Hist. vol. 12, p. 176.

† One species, *Macrochelys taciturna* (*Glyptocheilus*, Ag.) Holbrook's N. A. Herp., i, p. 147; Agassiz's Cont., i, p. 414, ranges from Georgia, Alabama, Mississippi, Louisiana, and Texas, north to Illinois and Missouri.

costals very large, nearly quadrilateral, the lower edge rounded, the first costal largest, almost triangular; marginal plates twenty-four or twenty-five; of sternal shields, the abdominal much the largest. Length of carapax, 1 foot; length of head and neck, 7 inches; height of carapax 4 inches.

Habitat, Ecuador, Florida and Louisiana; north to Missouri, Indiana, Michigan, Canada and Maine.

This species is not only common in all parts of the State, but is frequently met with throughout its whole range. It is usually known as the Snapping Turtle, though called also Land Turtle, Snake, and Ser-rated Tortoise in the north, and Loggerhead and Alligator Terrapin in the south.

It is a ferocious animal; when annoyed it throws itself into an attitude of defence, snaps violently with its mandibles inflicting a severe wound, and will not let go its hold even after the cutting off of its head. They live in ponds and muddy streams, but are occasionally found at a distance from water. Oviposition occurs the latter part of June, a hole being scooped out in the sand, and from sixty to seventy elliptical eggs deposited therein. These eggs as well as the turtles, are by some esteemed a luxury for food, in fact the writer has known persons to keep the animals for a long time in a barrel with dish water, sour milk, and refuse from the table generally, in order to fatten and prepare them for use. The young are considered preferable. In advanced life the meat becomes rank, and at times emits a musky odor, rendering it unpalatable. Those found around Ann Arbor, Michigan, have a large number of fresh water algæ growing upon their carapax.

This species is well marked, being characterized by its powerfully hooked jaws, its spinous caudal crest and small cruciform plastron composed of twelve plates. The only species with which it can be confounded is *Macrochelys lacertina*, which probably is not found in the State.

FAMILY EMYDIDÆ. POND TURTLES.

Head, neck, and feet moderate, the latter more or less palmate; mandibles horny, the upper not hooked; carapax oval or oblong, broadest posteriorly, usually depressed, but highest medially, and composed of hard osseous plates, never soft and leathery; sternal shields twelve, usually soldered immovably together and to the carapax, forming a large, oval or oblong plastron; knees and elbows not slipping in naked among the viscera; animals living for the most part in marshes, and in or along the edges of ponds, pools, and streams; young living almost exclusively in water, much more so than the adult.

KEY TO GENERA OF EMYDIDÆ.

- * Upper jaw notched anteriorly. *a.*
- * Upper jaw not notched anteriorly, or with only a sinuous indentation. *b.*
 - a.* Carapax not carinate. *c.*
 - a.* Carapax carinate. CHELOPUS.
 - b.* Vertebral keel persistent in the adult; lower jaw with a spoon shaped dilatation. GRAPTOMYS.
 - b.* Vertebral line in adult tuberculated; horny sheath of jaw straight; extralimal. * MALACOCLEMMYS.
 - c.* Carapax considerably arched, and usually more or less spotted on the vertebral and costal plates. *d.*
 - c.* Carapax depressed; vertebral and costal plates not spotted. *e.*
 - d.* Plastron without a movable transverse hinge; costal and vertebral plates with isolated, round, nonconfluent yellow spots. NANEMYS.
 - d.* Plastron with a movable transverse suture; vertebral, and usually the costal plates, without round yellow spots. EMTS.
 - e.* Alveolar surface of jaw not divided by a longitudinal ridge; neck, legs and tail often with bright red stripes. CHRYSOMYS.
 - e.* Alveolar surface of jaw with a ridge parallel to cutting edge; no scarlet stripes. PSEUDOMYS.

GENUS CHELOPUS. Rafinesque.

Upper jaw with a distinct notch anteriorly; lower jaw straight except at tip, or arched upward; horizontal alveolar surface narrow; sides of head compressed; plastron immovably soldered together and to the carapax; head compressed laterally; carapax elongated, considerably arched, and provided with a keel.

* A dark orange blotch on each side of the neck extending over the temporal muscles; extralimal, New York, New Jersey, and Pennsylvania. † C. MUHLBERGII.

* Sides of neck without such spots. C. INSCULPTUS.

CHELOPUS INSCULPTUS LeConte.

Sculptured Tortoise.

Testudo insculptus, LeConte, Harlan.

Emys scabra, Say.

Emys insculptus, LeConte, Holbrook, DeKay, Storer.

Emys pulchella, Dumeril and Bibron.

Emys speciosa, Gray.

Glyptemys insculptus, Agassiz, Verrill, Allen.

Chelopus insculptus, Cope, Jordan.

* One species *Malacoclemmys palustris* (*Emys palustris*, et *terrapin*, DeKay), Agassiz's Cont., i, p. 437; Holbrook's N. A. Herp., i, p. 87; DeKay's Rept. N. Y., p. 10, ranges along the Atlantic coast, in salt marshes, from New York to Texas and South America.

† Agassiz's Cont., i, p. 443; Holbrook's N. A. Herp., i, p. 45; DeKay's Rept., p. 17.

Color above brown, often tinged with reddish; neck often with a yellow line upon side, but not a prominent blotch; plastron yellow, with black blotches; under side of neck, legs, and tail reddish, sprinkled with black; plates of the carapax with concentric and radiating striae on each, strongly marked, often with fine tuberculous points within: vertebral plates transversely oblong, hexagonal, and alternating with the costals; the first pentagonal, the last irregularly sub-hexagonal; marginal plates twenty-five, with a wave-like indentation, and a distinct notch behind; plastron with a deep notch between the two anal plates; preanal plates broader than the pectoral; all the plates of the plastron quadrilateral except the gular, which are triangular; sternal shields often with visible concentric striae. Length, 8-10 inches.

Habitat, Maine, Massachusetts, New York, New Jersey, and Pennsylvania; west to Eastern Ohio.

Rare in the State.

The Sculptured Tortoise, called also Wood Turtle, and Fresh Water Terrapin, occurs usually in dry fields, but I have seen them in meadows and along the borders of streams in spring. They are much less aquatic than any of the other genera of the family, and in early spring the males and females seemed to be together in damp localities. Later I was able to find only females, and these were uniformly filled with eggs. I had an opportunity from April to June, 1878, of observing them near Poughkeepsie, N. Y., and in numerous cases found their flanks covered with leeches, also saw small Helicidae adhering to their limbs, thus showing one of the means of distribution of the latter group of animals. They repair in autumn to streams and ponds, and prepare to hibernate by burying themselves in mud. They are timid and retiring animals, but when excessively irritated will snap at the offensive object, their means of defence being a withdrawal into, and closure of the shell around them. They emit a piping note, and feed upon the low field blackberry and other vegetables.

GENUS EMYS. Brogniart.

Carapax elongated, keelless, oval, considerably arched, and broadest posteriorly; plastron with a more or less movable transverse hinge between the pectoral and abdominal plates, and joined to the carapax by a ligamentous suture; head depressed; tympanum distinct; upper mandible notched; alveolar margins narrow; eyes and nostrils large.

EMYS MELEAGRIS Shaw.

Blanding's Box Tortoise.

Testudo meleagris, SHAW.

Lutremys meleagris, GRAY, LECONTE.

Cistudo blandingii, HOLBROOK, DEKAY, STORER.

Emys meleagris, AGASSIZ, COPE, JORDAN.

Carapax above jet black, with numerous, irregular, yellow, more or less confluent blotches, giving it in places the appearance of a black and yellow marbling, but often the yellow is entirely wanting; plastron sometimes yellow, but usually black, each plate usually with its inner and anterior border somewhat yellow; head and nape black, often with reddish or yellow blotches; lower mandible yellow; gular region yellow, usually more or less clouded with dark; head above covered with a soft skin; feet and tail scaly; tympanum and nostrils large; lower jaw with a small hook; commissure of mouth much curved; neck long; eyes large; marginal plates twenty four or twenty-five; costals large, the first largest, the second and third nearly quadrilateral, the fourth rhombic; first vertebral four sided, broadest anteriorly, last septagonal, the four lower sides short, to articulate with the four posterior marginals, the remaining three sides about twice as long, the upper border rounded or projecting; the remaining neural plates hexagonal, the anterior and posterior borders nearly twice the length of the lateral; costal and vertebral plates alternating; carapax entire in front, notched behind; plastron elliptical, entire anteriorly but broadly notched posteriorly; sternal shields all four-sided except the gular, which are triangular, with the most acute angle posteriorly; tail rather small; toes five in front and four behind. Length of carapax, 9 inches; length of neck and head, $5\frac{1}{2}$ inches; height of carapax, $2\frac{3}{4}$ inches; tail from anus, 2 inches.

Habitat, New Hampshire, Massachusetts, Michigan, Wisconsin, Indiana, and Illinois.

The *Emys melleagrís* seems to be rare everywhere. It was described by Dr. Holbrook as coming from the prairies of Illinois, and afterwards noted by Dr. Storer as found along the Fox River. It has been subsequently seen in various parts of the states named, and, though as yet I have no knowledge of its having been observed in Ohio, its range is such, having been found at Ann Arbor, Michigan, among other places, that I doubt not it will be detected in the State. The most northern limit at which it has been observed is, I believe, Haverhill, New Hampshire, and Racine, Wisconsin, the former being in latitude 44° .

Being somewhat longer than its European analogue, *Emys lutaria*, it has been needlessly confounded with *Cistudo clausa*, from which it may readily be distinguished by its upper mandible being notched at the apex, and the absence of a downward curve or hook of the beak. The carapax is also much longer and devoid of the keel, and the plastron with its transverse movable suture less marked, and its posterior end broadly notched or truncated, thus rendering the anal plates four-sided instead of triangular.

A specimen before me had the carapax marked eleven years ago, and has lost one limb, the wound of which has healed perfectly.

GENUS NANEMYS. Agassiz.

Upper jaw with a notch at apex; lower mandible arched upwards; snout rounded, not laterally compressed; carapax carinate, considerably arched and elongated; plates of plastron immovable, united together and to the carapax; neck and legs scaly.

NANEMYS GUTTATUS. Schneider.

Speckled or Spotted Tortoise.

Testudo guttata, SCHNEIDER, SHAW.

Testudo punctata, SCHNEIDER, SCHÆPFF, LATREILLE, DAUDIN, LECONTE.

Emys punctata, MERREM, SAY, HARLAN, KIRTLAND.

Emys guttata, SCHWIEGGER, HOLBROOK, STORER, GRAY, DEKAY, DUMERIL and BIBRON.

Clemys punctata, WAGLER.

Chelopis guttatus, COPE.

Nanemys guttatus, AGASSIZ, JORDAN.

Color of carapax black, with here and there an isolated round or nearly round yellow spot; plastron yellow, with more or less black, sometimes almost or entirely black; marginal plates yellow, or yellow and black beneath; head, neck, and chin brown or black, with reddish-yellow spots; feet dark colored, reddish or yellowish beneath; marginal plates twenty-five, nuchal narrow, elongated; first vertebral pentagonal, the anterior margins shorter; last neural septagonal, rarely hexagonal, the remaining vertebral shields nearly hexagonal; costals four, the first, second, and third largest; costal and vertebral plates alternating; a groove in the plastron and carapax in front for the neck; gular shields triangular, the remaining sternals with four sides; plastron behind broadly notched, carapax nearly or quite entire; sternal shields often with concentric striae. Length of carapax, 5 inches; height of carapax, $1\frac{1}{2}$ inches; length of tail, $1\frac{1}{2}$.

Habitat, Massachusetts, New York, Pennsylvania, and North Carolina, to Michigan and Indiana.

Agassiz states that this species "does not extend south of North Carolina, nor west of New York and Pennsylvania," but the Museum of Michigan University contains a specimen taken in Ionia county, Michigan, by Prof. J. B. Steere; it has also been found at Ann Arbor, and Dr. Levette of the Indiana Geological Survey reports it as occurring in the northern part of that State. Dr. Kirtland reports it as rare in Ohio, and hence, though not having myself seen it, I think, without question, it should be included in the fauna of the State.

The Spotted Turtle frequents sluggish streams, ponds, and ditches with muddy bottom, but I have never seen them where the water itself was muddy. I have observed them in New York inhabiting the same ponds as *Chrysemys picta*, and about as numerous. They never left the water except to lay their eggs, which they did in June or July. They were frequently observed sitting upon the edges of ponds and upon logs, but in all cases plunged suddenly when approached. They go into winter quarter in the fall by burying themselves in mud. The yellow spots are very characteristic and appear earlier than the lungs or family characters.

GENUS GRAPTEMYS. Agassiz.

Head, neck, and feet rather slender; upper mandible curved, sometimes with a bare trace of a notch at the apex, lower jaw with a spoon-shaped dilatation; carapax de-

pressed with a persistent keel; plastron immovably soldered together and to the carapax; outer side of fore legs with a row of scales; toes five in front and four behind; posterior feet with the toes broadly palmate.

* Head and neck with yellow lines, often reticulated, and a single spot on each side or none; keel not very prominent. G. GEOGRAPHICA.

* Head with large yellow blotches or stripes; keel very prominent. G. LESUEURII.

GRAPTEMYS GEOGRAPHICA LeSueur.

Geographic or Map Turtle.

Testudo geographica, LESUEUR, LECONTE, HOLBROOK.

Emys geographica, LECONTE, KIRTLAND, DEKAY.

Emys macrocephala et megacephala, HOLBROOK.

Emys labyrinthica, LESUEUR.

Graptemys geographica, AGASSIZ.

Malacoclemmys geographica, COPE, JORDAN.

Color of carapax olivaceous to brown, with a network of yellow stripes interlacing in such a manner as to give a cellular appearance, these markings not so prominent in the center, and in some specimens nearly or quite obsolete; plastron yellow, often black in the center; head above dark olive, with numerous yellow longitudinal lines, and often a small spot of the same color as above, and with similar lines; legs and tail olivaceous, with yellow stripes; under sides of marginal plates yellow, with brown spots containing yellow lines within; plastron and carapax hollowed out in front to fit the neck, and notched behind; marginal plates twenty-five, the anterior narrow, but broadest behind; costal and vertebral plates alternating; first neural nearly quadrilateral, with a projection back wards, the last septagonal, irregular; gular triangular; the remaining sternal shields four sided, abdominal much the largest; anterior angle of anals received into a depression between the two preanals; tail short and thick; tympanum not prominent. Length of carapax, 9 inches; height of carapax, 2½ inches; tail from anals, 1½ inches.

Habitat, New York, Pennsylvania, Michigan, Ohio, Indiana, Illinois, and Arkansas.

The Geographic Tortoise probably occurs in every part of the State, having been obtained at Toledo, Rockport, and Cincinnati. They are very bold, active, vigorous animals, approaching even the Chelydridæ in disposition, and their flesh is said to be very palatable.

A specimen before me shows an abnormality, having an extra vertebral and two extra costal plates, one on each side.

GRAPTEMYS LESUEURII Gray.

Pseudogeographic Tortoise or Lesueur's Map Turtle.

Testudo geographica, var. *b*, LESUEUR.

Emys geographica, GRAY, var. *a*, LECONTE.

Emys lesueurii, GRAY.

Emys pseudogeographica, HOLBROOK, DEKAY.

Graptemys lesueurii, AGASSIZ.

Malacoclemmys pseudogeographicus, COPE, JORDAN.

Color of carapax, plastron, limbs and tail, same as the preceding, but the yellow

markings upon the shell are usually more intense; head brownish, with longitudinal lines and lateral blotches of yellow, one of these blotches in front and another behind the ear, a third between the eye and the angle of the mouth; costal and vertebral plates alternating: first neural pentagonal, last almost triangular, the remaining vertebral hexagonal; plastron elliptical, broadly emarginate behind; gular triangular, the remaining sternal shields quadrilateral; carapax higher than in the preceding species, more strongly carinated. Length of carapax, $5\frac{1}{2}$ inches.

Habitat, Michigan, Ohio, Wisconsin, Missouri, Iowa, Kansas, Arkansas, and Louisiana.

This species, which seems to have a range of the whole Mississippi Valley from the Sault St. Marie on the north to Louisiana on the south, is occasionally, though rarely, found in the State. It is usually known under the specific name of *pseudogeographica*, but Gray's name, *lesueurii*, is older, and hence entitled to precedence.

GENUS CHRYSEMYS. Gray.

Head moderate; upper jaw curved laterally, and notched at the apex; mandibles narrow; legs and tail scaly; toes five in front and four behind; hind feet broadly palmate; carapax depressed; plastron elliptical, shields immovable, soldered together and to the carapax.

* Costal and vertebral shields in transverse lines of three each. C. PICTA.

* Costal and vertebral shields alternating. C. MARGINATA.

CHRYSEMYS PICTA Herm.

Painted Turtle.

Testudo picta, HERM, SCHNEIDER, GMELIN, SCHAEFF, SHAW, DAUDIN.

Testudo cinerea, SCHNEIDER, SHAW, SCHAEFF.

Emys picta, SCHWEIGGER, MERREM, SAY, FITZINGER, GRAVENHORST, LECONTE, HARLAN, GRAY, DUMERIL and BIBRON, HOLBROOK, KIRTLAND, STORER, DEKAY.

Emys cinerea, SCHWEIGGER, MERREM.

Chrysemys picta AGASSIZ, ALLEN, COPE, JORDAN.

Chrysemys dorsalis, AGASSIZ.

Color of carapax olive to brown, with irregular yellow lines margined with black; vertebral line narrow, yellow; plastron orange or yellow, often black in places; head brown, with yellow spots; neck, feet, and tail dark brown, with bright yellow and scarlet spots or bands; gular region brownish, with red and yellow stripes; eyes moderate; pupils black; irides golden, with a dark line passing through their center; costal and vertebral plates in transverse rows three in each, never alternating; first neural quadrilateral, last pentagonal; middle vertebral shield quadrangular; second and fourth hexagonal; marginal plates twenty-five, with a bright red blotch in their center and two red lines above it; a broad yellow band margined with black along the anterior margin of each row of costal and vertebral plates; gular and anal plates triangular, the remaining sternal shields quadrilateral; pectoral much the largest. Length of carapax, 6 inches; height of carapax, $2\frac{1}{2}$ inches; tail to anus, $1\frac{1}{2}$ inches.

Habitat, New Brunswick, Maine, Massachusetts, New York, North Carolina, South Carolina, Georgia, Mississippi, and Louisiana, to Lake Superior, and Eastern Ohio.

This is a very beautiful Turtle, the markings varying considerably, and the young being more brilliant than the adult. They inhabit still, never running water, occurring in ponds and muddy places, where they may be seen setting upon the tanks or upon logs, but plunging suddenly, if approached. They are decidedly aquatic animals, and are unable to survive many days, if removed from the water. They are timid and inoffensive, emit a piping note; and after attaining her eleventh year the female, in a June evening, digs a perpendicular hole in which she deposits her elliptical eggs.

CHRYSEMYS MARGINATA Agassiz.

Lady Turtle or Agassiz Turtle.

Chrysemys marginata, AGASSIZ.

Chrysemys bellii, GRAY.

Chrysemys picta, var. *marginata*, COPE, JORDAN.

Color above of carapax varying from bronze green to brown, usually with a narrow vertebral line of yellow margined with black; anterior margin of each plate usually with a similar line; second or third costal at times with a bright yellow or red spot; marginal plates brown to black, with various yellow or red markings; head brownish, with yellow spots or lines; neck, legs, and tail with red lines; plastron yellow, with a central dark blotch; carapax flatter, broader, and more rounded than in *Chrysemys picta*; vertebral and costal plates alternating, never forming transverse rows of three each; first neural quadrangular, with sinuous sides, last heptagonal, the lower sides shorter; the three central vertebral shields hexagonal; lateral margin of costal, first and last neural shields often with parallel ridges; plastron with the gular and anal plates triangular, the remainder quadrilateral; abdominal the broadest, and pectoral narrowest. Length of carapax, 6 inches; height of carapax, $2\frac{1}{4}$ inches; tail to anus, $1\frac{1}{2}$.

Habitat, New York?, Michigan, Ohio, Indiana, Wisconsin, Iowa, and Missouri.

This species seems to replace *Chrysemys picta* in the west, and in Michigan it is quite common, while *picta* is very rare, if at all. In Ohio, *picta* is found occasionally in the eastern part of the State, never so far as I know in the west, while *marginata* occurs in the western portion.

A specimen before me from Waterloo, New York, which from general appearance I take to be a variety of *Chrysemys marginata*, has six costal shields on one side and seven on the other. It has in the center of the carapax, apparently a large vertebral plate, replaced by four small ones, in addition to which it has five, the normal number, median dorsal shields; the four central plates are arranged in pairs of unequal size, the posterior one on the right side being much the smaller. Such an abnormality I do not find recorded of any turtle.

This species and *C. picta* are about equally abundant in Ohio, and

their habits are remarkably similar. *C. marginata* ranges as far north as Lake Superior, and, in the latitude of Ann Arbor, Michigan, has been found out of winter quarters as late as October 22, and in the spring on March 31. They undoubtedly attain to a good age. A plastron before me of this species was discovered in Sharon, Wastenaw county, Michigan, in 1838, by Dr. C. B. Porter, who inscribed the date and his name upon it. The animal was again discovered within half a mile of same spot in 1868. The size of the letters and figures show that the plastron could not have grown perceptibly during this period of thirty years. From this and other cases where people have inscribed their names and dates upon them, we may safely conclude that some, if not all, of our land and fresh water turtles wander to but a short distance, grow slowly, if at all, after attaining a length, in this species, of eight inches. In the case of *Cistudo clausa*, sixty years elapsed between the time of the inscription and its rediscovery, and it then, as in this species, was found within half a mile of the place where it was originally marked.

FAMILY CINOSTERNIDÆ. THE CINOSTERNOID TURTLES.

Feet palmate; toes four or five, fingers five; carapax high, narrow and composed of hard osseous plates; plastron small, between cruciform and elliptical, with only seven, nine or eleven shields; marginal plates twenty-three, vertebrals five, narrow, becoming broader posteriorly; costals large, four on each side; margins of carapax turning downward and inward instead of outward; head pointed; sockets of eyes deep.

† Plastron oval with movable hinge between the pectoral and preanal plates, allowing it to close the shell. CINOSTERNUM.

† Plastron cruciform; no movable hinge behind; incapable of closing the shell. AROMOCHELYS.

GENUS CINOSTERNUM. Spix.

Head sub-quadrangular, pyramidal and broad; superior maxillaries rather widely separated behind; jaws slightly hooked with an inframental papilla; cranium with a single rhomboidal plate; plastron oval; pectoral and preanal plates articulated by a movable suture allowing the animal to close the shell; vertebral plates somewhat imbricate; tail long, and unguiculate in the males.

CINOSTERNUM PENNSYLVANICUM Bosc.

Mud Tortoise.

Testudo pennsylvanica, Gmelin, Schœpff, Latreille, Shaw, Audin, Edwards.

Emys pennsylvanica, Schweigger, Harlan.

Terrapene pennsylvanica, Merrem, Schinz.

Cistudo pennsylvanica, Say.

Kinosternon pennsylvanicum, BELL, BONAPARTE, LECONTE, HOLBROOK, DEKAY, GRAY.

Cinosternon pennsylvanicum, WAGLER, DUMERIL and BIBRON.

Thyrosternum pennsylvanicum, AGASSIZ.

Color of carapax dusky brown, of plastron yellow or orange with dark blotches; sometimes having the sutures margined with black; head and neck brownish, with whiter stripes and spots; feet and tail chestnut, lighter beneath; carapax oval, emarginate behind; first vertebral shield triangular, its apex posterior and truncate; second, third, and fourth hexagonal; costals large; marginals elevated; plastron notched behind; abdominal plates articulating with the pectorals and preanals by more or less movable sutures; sternal shields all deeply sculptured with parallel and angular lines; head large; upper and lower jaw with a curved tooth-like projection; anterior limbs with two scaly folds above, small scales beneath, and terminating in five short claws; tail short with lateral tubercular processes and terminating in a horny point. Length of carapax, 4 inches; height of carapax, 1 4-5 inches; length of tail, 7 lines.

Habitat, New York, Pennsylvania, New Jersey, Florida, Alabama, Louisiana, Ohio, and Michigan.

This animal is found in ditches and muddy ponds; it feeds upon fish and small aquatic reptiles, and emits a strong musky odor.

GENUS AROMOCHELYS. Gray.

Head sub-quadrangular, pointed, and very large; jaws powerful; plastron cruciform, with a transverse more or less movable suture anterior to pectoral plates, but immovable behind; posterior end of plastron broadly notched or truncate; toes five; fingers five; tail moderate; carapax somewhat emarginate at least in the young; chin with warts; supplemental plates between the plastron and carapax contiguous to both.

AROMOCHELYS ODORATUS Latreille.

Musk Tortoise.

Testudo odorata, LATREILLE, DAUDIN, LECONTE.

Testudo pennsylvanica, SCHNEPP.

Cistudo odorata, SAY.

Emys odorata, SCHWEIGGER, HARLAN, KIRTLAND.

Sternotherus odoratus, BELL, HARLAN, HOLBROOK, STOREY, DEKAY.

Sternotherus boscai, BELL.

Kinosternon odorata, GRAY, LECONTE.

Kinosternum shavianum, BELL.

Staurotypus odoratus, DUMERIL and BIBRON.

Ozotheca odorata, et *tristycha*, AGASSIZ.

Ozotheca odorata, ALLEN.

Aromochelys odoratus, COPE, JORDAN.

Color of carapax olive to brown or green; head and neck similarly colored, with yellow stripes on each side; plastron black and yellow; colors very much obscured by the adhering mud; pupils black; irides golden; anterior marginal plate very narrow, broadened behind; first costal very large, the second and third pointing apical, the two upper sides much the shortest, the anterior and posterior margins longest; four hinder mar-

ginals much the higher, making an upward curve or indentation into the posterior costal on each side; last vertebral quadrangular, broadest behind, with a slight projection downward between the two posterior marginals; first neural elongated, broadest anteriorly; vertebrae slightly imbricated, alternating with the costals; carapax slightly emarginate behind, arched upward over the neck; gular plate nearly triangular, the remaining sternal shields more or less quadrilateral; abdominal much the largest; tail short, with several rows of pointed warts; neck, legs, and feet granulated; fore legs with scaly plates, and bases of feet with scales; no plates on the posterior limbs. Length of carapax, $4\frac{1}{2}$ inches; height of carapax, $1\frac{3}{4}$ inches; breadth of carapax, 3 inches; length of tail, 1 inch.

Habitat, Maine, Massachusetts, New York, South Carolina, Georgia, Florida, Alabama, and Louisiana, to Tennessee, Ohio, Michigan, Indiana, and Missouri.

The Musk Tortoise inhabits ditches and ponds, burying itself in mud. It is an active animal, and bites with considerable vigor if irritated. It has a very disgusting odor from which, with its habits, it has received not only its specific, but also its various common names, such as *Musk Turtle* and *Stinkpot* in the north, and *Mud Terrapin* in the south. It occurs in Northern Ohio and probably also occasionally through the whole State. It oviposits in June and July.

FAMILY TRIONYCHIDÆ. THE SOFT-SHELLED TURTLES.

Carapax in the form of a flattened orbicular disk, never completely ossified, its margins soft and flexible, and in some species with the ribs projecting; costal plates when visible eight pairs; posterior margin of carapax extending much beyond the body; sternum composed of four pairs of bones and one odd one; plastron a leathery covering with or without the sternal bones being visible externally; feet broadly palmate; head and neck very long and flexible; nostrils carried forwards by a long tubular projection; temporal arch narrow; parietal bones slightly if at all projecting outward; pterygoids broad, with slight depressions on their external edges; sphenoids extending forward between the pterygoids to the palatines; inner nares large, and situated far back.

The *Trionychidæ* are usually found at the bottom of shallow water buried in mud. They remain thus buried, raising their head and long flexible snout to the surface for the purpose of respiration. Thus the long flexible neck, head, and snout as well as the soft covering correspond to the habits of the animal, as a hard carapax and plastron are unnecessary for the purposes of protection to them while buried in the mud. In burrowing they go under a thin layer horizontally by digging with the fore feet, bracing and pushing the body under with the hind ones.

* Septum of nose without any internal ridges on each side. AMYDA.

* Septum of nose with a ridge on each side. ASPIDONECTES.

GENUS AMYDA. Schweigger.

Head long, narrow, and pointed anteriorly; horizontal alveolar surface of jaw narrow, broadest behind, and with a downward curve of the upper under the eye; lower

mandible compressed laterally, and extended forward; mandibular edges sharp; nostrils situated under rather than at the end of the proboscis; nasal septum smooth or without any transversely projecting ridge.

AMYDA MUTICA LeSueur.

Leathery Turtle.

Trionyx muticus, LESUEUR, LECONTE, KIRTLAND, DEKAY, GRAY.

Gymnopus mutica, DUMERIL and BIBRON.

Amyda mutica, AGASSIZ, COPE, JORDAN.

Color of upper parts olivaceous to brown, with darker spots upon the carapax; beneath more or less whitish without spots or mottled marks; carapax oval, smooth, depressed along the vertebral line instead of carinate; anterior margin of carapax naked, that is without spines or tubercles; anterior feet with three broad scales which are acute above and anteriorly, and with two oblong tubercles behind; tail short; young with band on the head and neck. Length, 8 inches.

Habits, New York, Pennsylvania, Ohio, Indiana, Michigan, Iowa, and Missouri.

This species seems to have its range over the waters of the Mississippi, and also of the Great Lakes, being according to LeSueur common in Lakes Erie and Ontario. In the State it also occurs in the Ohio River. The tail in the males is longer than in the females; in the latter it does not extend beyond the margin of the carapax.

GENUS ASPIDONECTES. Wagler.

Head broader than in *Amyda*, curving rapidly downward from a line between the orbits; mandibles corneous, narrow, and nearly straight; nostrils terminal, with a transverse projection upon each side of the septum; mouth broader and rounder than in *Amyda*; feet very broadly palmate; with three claws on each exerted.

ASPIDONECTES SPINIFER LeSueur.

Soft-shelled Turtle.

Trionyx spiniferus, LESUEUR.

Trionyx ocellatus, LESUEUR.

Trionyx ferox, KIRTLAND, DEKAY, not of Schweigger and others.

Aspidonectes ferox, WAGLER.

Gymnopus spiniferus, DUMERIL and BIBRON.

Aspidonectes spinifer, AGASSIZ, COPE, JORDAN, COUES, YARROW.

Color of carapax dark slate, with ocellate spots above, and often with black dots along the margin; plastron creamy white; head and neck dark above, light brown, or a marbling of black and white beneath; a light stripe extends from the eye backward; carapax with a vertebral ridge slightly elevated, its center hard, its margins soft with the ribs projecting; costal plates eight on a side, distinct in adult; anterior margin of carapax with a row of spines or denticulated; fore limbs with transverse elevations; feet large and very broadly palmate; claws on each, three; tail anterior to anus very thick, beyond

narrow and short; shoulders broad, on a line with anterior portion of carapax; eyes prominent and almost vertical; cleft of mouth extending behind the eyes; shell above with numerous minute tuberculations or depressions.

The young differs from the adult by having the shell lighter colored, in some nearly cream, its anterior margin denticulated, the costal plates not separable, and the hard shields of plastron not discernable. Length of carapax, $9\frac{1}{2}$ inches; height of carapax, 3 inches; breadth of carapax, $8\frac{1}{2}$ inches; length of head and neck, 6 inches.

Habitat, New York, Pennsylvania, Michigan, Ohio, Indiana, Illinois, Wisconsin, Missouri, Iowa, and Montana.

This species is said to be the most delicious and nourishing as food of any of the *Testudinata*. They may be caught with a hook, but are usually speared. They are abundant in all the streams flowing into the Ohio and Lake Erie. Dr. Kirtland observed them in calm weather floating near the surface of the water, and followed by several Black Bass. The statements about its ferocity vary, probably owing to its having been confounded with *Aspionectes ferox*.

Extralimital North American Testudinata, not previously mentioned in this work.

Aspionectes (Pallypeltis, Ag.) ferox, Schweigger.

HOLBROOK, N. A. Herp., ii, p. 11.—AGASSIZ, Cont. Nat. Hist. U. S., i, p. 401.

Habitat, Georgia, Florida, Alabama, Mississippi, and Louisiana.

Aspionectes asper, Agassiz.

AGASSIZ, Cont., i, p. 405.

Habitat, Mississippi and Louisiana.

Aspionectes nuchilis, Agassiz.

AGASSIZ, Cont., i, p. 506.

Habitat, Cumberland and Upper Tennessee Rivers.

Aspionectes cmoryii, Agassiz.

AGASSIZ, Cont., i, p. 407.

Habitat, Texas.

Aromochelys carinatus (*Goniocelys triquetra, et minor*, Ag.) Gray.

AGASSIZ, Cont., Nat. Hist., U. S. p. 423.—U. S. Geolog. Surv., 100th Meridian, vol. v., p. 582.

Habitat, Missouri to Louisiana, Texas, and Arizona.

Cinosternum sonoriense, LeConte.

Proc. Acad. Nat. Sci. Phila., 1854, p. 184.—U. S. Geolog. Surv., 100th Meridian, v., 5, p. 89.—AGASSIZ, Cont., Nat. Hist. U. S., i, p. 423.

Habitat, Arizona and Mexico.

Cinosternum integrum, LeConte.

Proc. Acad. Nat. Sci., Phil., 1854, p. 183.—AGASSIZ, Cont. Nat. Hist. U. S. i, p. 430.

Habitat, Mexico.

Cinosternum (Platythyra, Ag.) flavescens, Agassiz.

AGASSIZ, Cont. Nat. Hist., U. S., i, 430.

Habitat, Arkansas, Texas, and Arizona.

Cinosternum henrici, LeConte.

Proc. Acad. Nat. Sci. Phil., 1859, p. 4.—U. S. Geolog. Surv., 100th Meridian, vol. v, p. 533.

Habitat, New Mexico and Arizona.

Pseudemys (Ptychemys, Ag.) rugosa, Shaw.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 431.—HOLBROOK, N. A. Herp., i, p. 55.—DEKAY, Rept. N. Y., p. 16, as *Emys rubriventris*.

Habitat, New Jersey to Virginia.

Pseudemys concinna, LeConte.

HOLBROOK, N. A. Herp., i, pp. 119-63.—AGASSIZ, Cont. Nat. Hist. U. S., i, p. 432.

Habitat, North Carolina, Georgia, Florida, Mississippi, Louisiana, Texas and Arkansas.

Pseudemys mobiliensis, Holbrook.

HOLBROOK, N. A. Herp., i, p. 71.—AGASSIZ, Cont. Nat. Hist. U. S., i, p. 433.

Habitat, Florida, Alabama, Louisiana, Texas.

Pseudemys hicroglyphica, Holbrook.

HOLBROOK, N. A. Herp., i, p. 3.—AGASSIZ, Cont. Nat. Hist. U. S., i, p. 434.

Habitat, "Indiana," and Tennessee to Georgia.

Pseudemys (Trachemys, Ag.) scabra, Linnaeus.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 434.—HOLBROOK, N. A. Herp., i, p. 123.

Habitat, North Carolina to Georgia.

Pseudemys troostii, Holbrook.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 436.—HOLBROOK, N. A. Herp., i, p. 123.

Habitat, Missouri, Illinois, Tennessee, and Mississippi.

Pseudemys elegans, Wied.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 435.—HOLBROOK, N. A. Herp., i, p. 115.—COUES and YARROW, Herp. Dakota and Montana, p. 260.

Habitat, Texas to Illinois, Missouri, Iowa, and Dakota.

Chrysemys oregonensis, Harlan.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 259.—COUES and YARROW, Herp. Dakota and Montana, p. 259.—U. S. Geolog. Surv., 100th Meridian, v, p. 583.

Texas and Arizona, to Minnesota, Nebraska, and Dakota.

Chrysemys (Dicrochelys, Ag.) reticulata, Bosc.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 44.—HOLBROOK, N. A. Herp., i, p. 59.

Habitat, North Carolina, Florida, and Alabama, to Louisiana.

Chelopus (Actinemys, Ag.) marmoratus, Baird and Girard.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 434.—Proc. Acad. Nat. Sci. Phila., 1852, p. 177.—Proc. Acad. Nat. Sci. Phila., 1854, p. 91 as *Emys nigra*.—U. S. Pac. R. R. Surv., vol. 12, p. 292.—WILLIAMSON, Report, p. 3.

Habitat, California to Puget Sound.

Cistudo ornata, Agassiz.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 445.—COUES and YARROW, Herp. Dakota and Montana, p. 266.

Habitat, Iowa to Upper Missouri.

Cistudo major, Agassiz.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 445.

Florida to Alabama.

ORDER OPHIDIA. SERPENTS.*

Body long and slender, serp-antiform; limbs none, but rudiments of the pelvic arch present in Pythons, Boas, and Tortrices; epidermal covering above in the form of scales, which are periodically cast off and renewed; head often with plates, under surface usually covered with scutellæ; integument very extensible; anal slit transverse; eyelids wanting; tympanum none; tongue long, bifid, sheathed at base, and capable of protrusion; teeth conical, not in sockets, situated upon the jaws and palate; mouth very dilatable owing to the presence of a quadrate bone; jugal, quadrate-jugal, sternum, orbits and aliophenoids absent; post-frontals, nasals, and lacrymals well developed; rami of lower jaw composed of several pieces; vertebrae numerous, the dorsal procelous; hear trilobular, composed of two auricles and a ventricle, the latter with a partial septum; lungs usually one, when two asymmetrical; urinary bladder wanting.

* An erectile poison fang in front part of the mouth; deep pit between the eye and nostril. CROTALIDÆ.

* A permanently erect poison fang in front part of mouth; lacrymal pit wanting; extralimal. ELAPIDÆ.

* No poison fang in front part of mouth; lacrymal pit wanting. COLUBRIDÆ.

FAMILY CROTALIDÆ. CROTALID SNAKES. .

Teeth in upper jaws few; *erectile poison fangs in front*; head usually triangular, plainly separable from the body; a deep pit between the eye and nostril: dorsal scales carinated; urosteges undivided anteriorly; species all venomous.

Tail provided with a rattle. a.

✓ Tail without rattle; cephalic plates large as in *Colubridæ*. b.

a. Top of head covered with scales, plates if any not reaching further back than the eyes. CROTALUS.

a. Cephalic plates large, and arranged as in *Colubridæ*. . . . CROTALOPHORUS.

b. Loral plate present. ANCISTRODON.

b. Loral plate absent. TOXICOPHIS.

GENUS CROTALUS. Linnaeus.

Cephalic region above covered with scales, a few large plates may be present anterior to a transverse line between the eyes; caudal rattle always present and well developed; body large and strong; pupil of eye vertical; lacrymal or nasal fossa very distinct; rostral plate large, temporals and labials small; the two anterior inframaxillaries large.

* For plates of heads, see U. S. P. R. R. Rep., vol. x; on classification of extralimal N. A. species, see Baird and Girard's Catalogue.

CROTALUS DURISSUS Linnaeus.

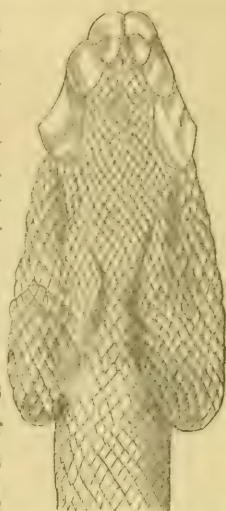
Banded Rattlesnake.*Uropsophus durissus*, GRAY.*Urocrotalon durissus*, FITZINGER.*Uropsophus triseriatus*, WAGLER.*Crotalus durissus*, HOLBROOK, DUMERIL and BIBRON, BAIRD and GIRARD, STORER, DEKAY*Crotalus horridus*, COPE.

General color sulphur-brown and darker brown, arranged in blotches or transverse bands; head very triangular, abruptly separable from the neck; superciliary plates small and numerous; upper labials 12-14, lower 13-15; rostral large, triangular, rounded above, anteorbitals two, elongated longitudinally; dorsals in 23 to 25 rows; gastrosteges 170 to 180; urosteges 23 to 28. Length, $3\frac{1}{2}$ feet; head, $1\frac{1}{2}$ inches; tail, 5 inches; transverse diameter of head, 1 inch; transverse diameter of neck, $\frac{1}{2}$ inch; circumference of body, $3\frac{1}{2}$ inches.

Habitat, Maine, Massachusetts, New York, Pennsylvania, West Virginia, South Carolina, Mississippi, Alabama, Kansas, and Arkansas.

The Banded Rattlesnake inhabits rocky mountains and hills, its venom is very virulent, but to its favor may be said that it rarely or never strikes unless stepped upon or interfered with in a serious manner, and then apparently acts only in self-defence. It also usually, though not always, gives warning and thus enables a person to get out of its way.

They are at times gregarious, being occasionally found collected together, especially in winter, but more usually they are alone. They are inactive, sluggish animals of slow locomotion, and in this respect contrast strangely with the rapidity of the vibrations of their tail, and the instantaneous quickness with which they strike an enemy. They have been known to live a year without food, but need water especially at the time of shedding their skin. The fangs are, in some cases at least, shed at the same time as the integument, and reproduced in a few days. They are believed to be most virulent at this time, which may be true, and may be



* FIG. 1.—*Crotalus durissus*, head covered above with scales.

* The plates which accompany this catalogue have been drawn from the specimens by Miss Lilly E. Chase, of Ann Arbor, Michigan.

It has not been my aim to insert a large number of illustrations, as this has already been done in the writings of Holbrook, DeKay, Agassiz, and the various United States Reports; and yet it is believed that the few given on the mouths of Salamanders and head of *Crotalus* and *Crotalophorus* will be very serviceable in the identification of genera.

explained by supposing that the venom accumulates owing to the fangs being shed.

Various theories have been advanced as to the use of the rattle, none of them being entirely satisfactory. One supposition is that it has resulted in time from the agitation of the highly nervous tail, and has no special function. *Pityophis melanoleucus*, the Bull Snake shows such an agitation, and its tail when in motion is said to somewhat resemble the rattle of this species. Again, it has been conjectured to be of use in calling the sexes together, and thus aiding in the preservation of the species. Another hypothesis is that, as it resembles the noise made by a grasshopper, it might be of service in decoying insectivorous birds within reach of the animal. The rattle is said to be heard often when there is no cause of irritation. If such be the case, it probably does not occur with the *Crotalidæ* in our limits. A fourth suggestion is that it serves to alarm the higher species, giving them warning, and thus enabling them to escape its bite. Such a hypothesis is contrary to all analogy, since nature's mode is to provide the animal with that which is best for its individual wants without regard to others. A last supposition is that it is of use to the serpent in terrifying its enemies. Probably this last is more worthy of credence, and is not to be set aside by the fact that it sometimes attracts the attention of enemies in such a way as to induce them to destroy it. In other cases it renders the snake more frightful, and enables it to paralyze its foes or desired prey with fear. It may also be of some use in the other ways mentioned, especially in bringing about the union of the sexes.

A popular belief is that one rattle is added each year; however, this cannot be true, as Dr. Holbrook knew a case of two rattles being added in a year, and Dr. Bachman observed a species in which four were developed in twelve months. Thus, we may see that the number of rattles is, as Dr. Holbrook observed, dependent upon the condition of the animal as regards liberty, nourishment, etc., and is no test of age.

The oil of this species is said to be very valuable.

GENUS CROTALOPHORUS. Linnaeus.

Cephalic region above covered with plates, which are seen posterior to a transverse line between the eyes; caudal rattle always present, though smaller than in Crotalus; body moderately strong; pupil vertical; rostral plate moderately large, temporals and labials small; the two anterior inframaxillaries large, the remainder small.

Dorsal rows of scales 26.	. . . . .	C. TERGEMINUS.
Dorsal rows of scales 23.	. . . . .	C. MILLARIUS.

CROTALOPHORUS TERGEMINUS Holbrook.

Prairie Rattlesnake or Massassauga.*Crotalus tergeminus*, SAY, HARLAN, DUMERIL and BIBRON.*Crotalophorus kirtlandii*?, HOLBROOK, DEKAY, COPE.

General color varying from ash to brown, spots of dark-brown margined with black, and exterior to this a still lighter circle; vertebral blotches 34 in number, almost quadrate, notched in front and behind, and extending from the neck to the tail; two or three series of lateral blotches on each side varying from circular to oblong; a light line begins upon the neck and, passing forwards, bifurcates, giving a branch to the upper and one to the lower jaw; a transverse line of light crosses the vertical plate; a white or yellowish line begins upon the neck, runs forward, bifurcates, and again nearly or quite meets in front so as to almost or quite enclose a dark blotch situated for the most part upon the occipital plates; beneath light colored to black; dorsal scales in 25 rows; gastrosteges 140-150; urosteges 25-30, the last three to five bifid; vertical plate sub-hexagonal, sometimes divided so as to leave a small triangular one behind; labials 11-12 below, 12-14 above; anteorbitals elongated longitudinally; rostral irregularly hexagonal. Length, 2 1-6 feet; head, 1½ inches; tail, 2¾ inches; transverse diameter of head, ¾ inch; of neck, ½ inch; circumference of body, 4 inches.



FIG. 2.—*Crotalophorus tergeminus*, showing cephalic region covered with plates.

Habitat, Michigan, Ohio, Illinois, Wisconsin, Kansas, Nebraska, Montana, Georgia, and "Indian Territory."

In the State I have only seen specimens from Warren county, but presume it occurs in all parts of Ohio. It lives in marshes, though I have seen it on elevated and dry grounds. Its bite is justly dreaded by persons compelled to frequent such places. It rarely, if ever, strikes without warning, and never unless disturbed.

Var. *kirtlandii*, also an inhabitant of Warren county, differs from this by being of a nearly uniform black with brown blotches above in the adult.

The specimen of *C. tergeminus* which I have seen from Wisconsin have a broader head, and the transition from head to neck is more abrupt than in Illinois or Ohio specimens, while a specimen from Lenawee county, Michigan, shows a head scarcely broader than the neck. It will thus be seen that the shape of the head as well as the coloration varies materially in this species.

CROTALOPHORUS MILIARIUS Linnæus.

Ground Rattlesnake.*Crotalus miliarius*, LINNÆUS, GMELIN, MERREM, SCHLEGEL, HARLAN, HOLBROOK, DUMERIL and BIBRON.*Caudisona miliarius*, FITZINGER, WAGLER.*Crotalophorus miliarius*, HOLBROOK, GRAY, DEKAY, BAIRD and GIRARD, COPE.

GENUS ANCISTRODON. Beauvois.

Cephalic region covered with nine large plates arranged as in Colubridæ; vertical and superciliaries on a line with the eye, occipitals farther back; anteorbitals two, elongated longitudinally; nasals two; loreal present, excluded from the orbit; head flattened, triangular; dorsal scales in 23 rows, carinated; tail rather short, tapering to a point, and without rattle; urosteges divided posteriorly.

ANCISTRODON CONTORTRIX Linnæus.

Copperhead.

Boa contortrix, LINNÆUS, GMELIN.

Agkistrodon mokason, BEAUVOIS.

Cenchrus contortrix, DAUDIN.

Cenchrus mokeson, HARLAN.

Scytalus cupreus, RAFINESQUE, HARLAN.

Toxicophis, TROOST.

Trigonocephalus cenchrus, SCHLEGEL.

Trigonocephalus contortrix, HOLBROOK, HALLOWELL, KIRTLAND, DEKAY, DUMERIL and BIBRON.

Ancistrodon contortrix, BAIRD and GIRARD, COPE, ALLEN.

Copper-colored above, brighter upon the flanks; reddish-brown transverse bands upon the back, about 16 in number, dilated upon the sides; rounded spots of a similar color between these bands; lateral blotches from 30-38, varying from round to sub quadrate, dusky; beneath pale cupreous; postorbital plates two, continuous under the eye with two small infraorbitals; superciliaries broad and long; vertical slightly longer than the occipitals, the latter notched posteriorly; labials, 8 above, 9 below; inframaxillaries small; gastrosteges, 150-155; urosteges, 40-50; tail terminating in a horny point, the analogue of the rattle in the *Crotalidæ*. Length, 29 inches; head, $1\frac{1}{2}$ inches; tail, $3\frac{1}{4}$

General color grayish ash, vertebral blotches varying from circular to triangular or elliptical, from 37 to 45 in number, each with a yellow border; a reddish-purple vertebral line extending from head to tail through the blotches; lateral blotches in two or three series; nape with a grayish to yellowish longitudinal band, with a black blotch on each side anteriorly; a narrow line of white extends from the angle of the mouth to the eye; vertical plate irregularly sub-hexagonal; labials, 10-11 on a side above, 11-12 below; anteorbitals two, elongated longitudinally; loreal one on each side; nasals two; rostral large, irregular, urn shaped, smallest above; dorsal scales in 23 rows; gastrosteges, 130-140; urosteges, 30-40, usually not well marked. Length, 17 inches; head, $\frac{3}{4}$ inch; tail, $2\frac{1}{4}$ inches; transverse diameter of head, $\frac{1}{2}$ inch; of neck, 3-16 inch; circumference of body, 2 inches.

Habitat, South Carolina, Georgia, Florida, Mississippi, Louisiana, and Arkansas.

DeKay records this species in Michigan, on what authority I am unable to determine. If it is a resident of that State it will doubtless yet be found in Ohio. However, its extreme southern range leads me to believe that its reference to the fauna of Michigan is a mistake, and that it probably does not occur within our limits.

inches; transverse diameter of head $1\frac{1}{2}$ inches; of neck, $\frac{3}{4}$ inch; circumference of body, 4 inches.

Habitat, Vermont, Massachusetts, Connecticut, New York, Pennsylvania, South Carolina, Florida, Alabama, Louisiana, Kansas and Ohio.

GENUS TOXICOPHIS. Troost.

Cephalic region covered with eleven plates, orbital and superciliaries in a line with eyes, the occipital situated more posteriorly; anteorbitals two, elongated longitudinally; nasals two; loreal absent; head triangular; dorsal scales carinated, in 25 rows; tail moderate, tapering to a corneous point; caudal rattle none; urosteges bifid posteriorly. Extralimital.

TOXICOPHIS PISCIVORUS Lacepede.

Water Moccasin.

Crotalus piscivorus, LACEPEDE.

Scytalus piscivorus, LATREILLE, DAUDIN, HARLAN.

Coluber aquaticus, SHAW.

Natrix piscivorus, MERREM.

Acontias leucostomus, TROOST.

Trigonocephalus piscivorus, HOLBROOK, GRAY, DUMERIL and BIBRON, DEKAY.

Toxicophis piscivorus, BAIRD and GIRARD.

Ancistrodon piscivorus, JORDON.

Color above brown, with dark vertical bars of black and red; head purplish-black; beneath black, blotched with dirty yellow; a yellow band in occipital region; vertical plate as long as occipitals; labials 8 above, 11 below; gastrosteges, 135-140; urosteges, 42-46. Length, 28 inches; head, $1\frac{3}{4}$; tail, $4\frac{1}{4}$; transverse diameter of head, $1\frac{1}{2}$ inches; of neck, $\frac{3}{4}$ inch; circumference of body 4 inches.

Habitat, North Carolina, South Carolina, Mississippi, Louisiana, Tennessee, Southern Illinois, and Arkansas.

The Water Moccasin is more aggressive than the Rattlesnakes, attacking everything that comes within reach. Its mode of attack is to erect its head, open its mouth, and strike without warning. It is decidedly aquatic, being always found near or in water, and in swampy places.

FAMILY ELAPIDÆ.

Teeth in both jaws; small poison fangs in front; body colubriiform; head oval, not separable from the neck, and covered with plates; pit between the eye and nostril wanting; dorsal scales smooth; urosteges bifid; tail pointed, without rattle. Extralimital.

GENUS ELAPS. Schneider.

Cleft of mouth moderate; cephalic and temporal region with plates; postorbitals two; anteorbitals one; nasals two; labials and inframaxillaries large; post-abdominal scutella entire.

ELAPS FULVIUS Cuvier.

Bead Snake.

Jet black, yellow and red bands alternating render this species easily recognizable.

Habitat, Virginia, Georgia, Florida, Mississippi, Texas, and Arkansas.

In the State it occurs along the waters of the Mahoning, Big Beaver, and Muskingum rivers, and also in the neighborhood of Cleveland.

The Copperhead is one of our most venomous species. It differs from the Rattlesnakes in that it strikes without warning. It is an indolent, sluggish animal, but when approached raises its head, thrusts out its tongue, and strikes at the intruder. It has various common names such as Hazel-head, Chunkhead, Red Viper, Copperbelly, Cotton-mouth, Dumb Rattlesnake, Red and Deaf Adder, but it is more usually designated as Copperhead. They, at least the pregnant females, are gregarious and occur in meadows or elevated grounds. They are, however, terrestrial, and appear to be ovoviviparous; at least according to Allen, five females out of seven, caught in the latter part of July in Massachusetts, contained slightly developed embryos, while of six females killed in September the ovaries of each contained seven or nine young, six inches long.

FAMILY COLUBRIDÆ. THE COLUBRINE SNAKES,

Conical teeth in both jaws; head oblong or oval, covered with large plates; poison fangs wanting; pupil of eye circular; lachrymal or nasal pit absent; body colubriiform; head tapering gradually into the neck; dorsal scales carinated or smooth; no anal appendages; urosteges bifid; tail conical, without rattle, tapering gradually to a point; species all believed to be harmless.

The following excellent table, fashioned after the Smithsonian Catalogue of Reptiles, by Baird and Girard, and Jordan's Manual, it is believed will enable anyone to readily refer a species to its proper genus.

Dorsal scales carinated. *a.*

Dorsal scales smooth. *i.*

a. Post-abdominal scutella entire. *b.*

a. Post-abdominal scutella bifid. *c.*

b. Dorsal rows of scales not exceeding 23. EUTÆNIA.

b. Dorsal rows exceeding 25. ; PITYOPHIS.

c. Loral and anteorbital plates both present. *d.*

c. Anteorbitals absent; extralimal. HALDEA.

c. Lorals absent. STORERIA.

d. Dorsal rows of scales 17 or less. CYCLOPHIS.

d. Dorsal rows of scales 19 or more. *e.*

e. Cephalic plates typical. *f.*

e. Cephalic plates not typical. *h.*

f. Postorbitals three, rarely two; anteorbitals usually one; dorsal rows of scales 23-29. TROPIDONOTUS.

f. Postorbitals two; dorsal rows of scales 19-21. REGINA.

h. Muzzle projecting and recurved. HETERODON.

h. Muzzle not projecting. COLUBER.

i. Anteorbital plates both present. *j.*

i. Anteorbitals absent. *m.*

j. Post-abdominal scutella entire, or bifid with 25 rows of dorsal scales.

OPHIBOLUS.

- j. Post-abdominal scutella bifid; dorsal rows of scales not exceed 21. *k*.
k. With a yellow ring round the neck. DIADOPHIS.
k. Without cervical ring. *l*.
l. Dorsal scales in 15 rows. LIOPELTIS.
l. Dorsal scales in 17 or more rows. BASCANIUM.
m. Dorsal scales in 19 rows. *n*.
m. Dorsal rows of scales not exceeding 17. *o*.
n. Prefrontals one. FARANCIA.
n. Prefrontals two. ABASTOR.
o. Postorbitals two; dorsal scales in 15 or 17 rows. VIRGINIA.
o. Postorbitals one; dorsal scales in 13 rows. CARPHOPHIS.

GENUS EUTÆNIA. Baird and Girard.

Body varying from long and slender to strong and moderately thick; cephalic plates normal; anteorbitals one; postorbitals usually three; loreal present; nasals two; prefrontals two; labials and inframaxillaries moderately large; dorsal scales strongly carinated, in 19-21 rows; gastrosteges, 140-170; post-abdominal scutella entire; urosteges, 50-120, all bifid; ground color dark, with a vertebral and two lateral stripes; habits terrestrial; species ovoviviparous.

Lateral stripe on the third and fourth rows of scales; body slender; tail nearly one-third of total length. *a*.

Lateral stripe on second and third rows of scales; body stouter; tail one-fourth of total length. E. SIRTALIS.

a. Urosteges less than 110. E. PROXIMA.

a. Urosteges 115 or more. E. SAURITA.

EUTÆNIA PROXIMA Say.

Say's Garter Snake.

Coluber proximus, SAY, HARLAN.

Tropidonotus proximus, BOIE.

Eutania proxima, BAIRD and GIRARD, COPE, JORDAN.

General color above black; vertebral band varying from yellow to brown; lateral stripes green or yellowish to white; occipital plates with a yellow spot about the center of the commissural line; abdomen and under parts varying from dingy white to olivaceous or green; vertical plate elongated, pentagonal, the posterior sides much the shorter, the lateral edges longest and arcuate to receive the projecting part of superciliaries; nasals two; rostral broad, but not very high; upper labials eight, lower nine or ten; temporal region covered with large plates; inframaxillaries reaching to the eighth lower labial; loreal rhomboidal; eye over the fourth and fifth upper labial; dorsal rows of scales nineteen, all carinated; vertebral band covering one and two half rows of scales; lateral stripes on the third and fourth rows from the abdomen; color below the lateral stripes somewhat lighter than above; body stouter than *Eutania saurita*; tail about two sevenths the total length; gastrosteges, 170-180; urosteges, 80-85. Length, $2\frac{3}{4}$ feet; head, 1 inch; tail, 9 inches; transverse diameter of head $7\frac{1}{2}$ lines; of neck $5\frac{1}{2}$ lines; circumference of body $2\frac{1}{2}$ inches.

Habitat, "California," Montana, and Arkansas, to Wisconsin, Ohio, North Carolina, Louisiana, Texas, and Mexico.

Rare in the State.

EUTÆNIA SAURITA Linnæus.

Swift Garter or Ribbon Snake.

Coluber saurita, LINNÆUS, HARLAN, STORER, KIRTLAND, THOMPSON.

Leptophis sauritus, HOLBROOK, DEKAY.

Tropidonotus sauritus, SCHLEGEL, DUMERIL and BIBRON, GUNTHER, PUTNAM, VERRILL, ALLEN.

Eutænia saurita, et faireyi, BAIRD and GIRARD.

Body very slender, elongated, tapering very gradually to an exceeding long, pointed tail: upper labials seven on each side, lower ten; inframaxillaries extending to seventh lower labial; vertical plate elongated, hexagonal; eyes large; general color above dark brown, with three longitudinal stripes, extending from the head to tip of tail, sometimes these stripes become indistinct after passing the anus, the vertebral one is very narrow, covering slightly more than one row of scales, and terminating in front on the posterior margin of the occipital plates, the lateral lines are somewhat broader, extending forward to the posterior labials, and situated upon the third and fourth rows of scales from the abdomen; orbital plates, lower part of head, and gular region yellowish-white; both sides of vertebral line and upper edge of lateral stripes margined with black. Abdomen and under parts greenish-white, without spots; gastrosteges, 175-180; urosteges, 115-120; dorsal scales in 19 rows, all strongly carinated. Length, 3 feet; head, $\frac{3}{4}$ inch; tail, 9 inches; transverse diameter of head, $\frac{1}{2}$ inch; of neck, $\frac{3}{8}$ inch; circumference of body 2 inches.

Habitat, Maine, Massachusetts, Connecticut, New York, Pennsylvania, Virginia, Ohio, Michigan, Wisconsin, Mississippi, Texas, Mexico, and Honduras."

Var. *faireyi*, Baird and Girard, has two small yellow spots on the occipital plates, a black lateral band bordered by two rows of black scales, thus making the color below the lateral stripe the same as that above, and the tail somewhat less than one-third the total length.

Habitat, Louisiana, Illinois, and Wisconsin.

The typical *Eutænia saurita* is common in Ohio, though I have as yet no record of the variety *faireyi* having been found in the State. It seeks damp or wet retired woods for its residence, is very nimble, climbs trees, and at times takes to water and swims readily. It has been popularly confounded with the next species, but is less active, and of a much slenderer form than *E. sirtalis*.

EUTÆNIA SIRTALIS Linnæus.

Striped or Garter Snake.

Coluber sirtalis, LINNÆUS, HARLAN, KIRTLAND, STORER.

Tropidonotus bipunctatus, SCHLEGEL, DUMERIL and BIBRON.

Tropidonotus tænia, DEKAY.

Tropidonotus sirtalis, HOLBROOK, VERRILL, ALLEN.

Eutainia sirtalis, parietalis, et dorsalis, BAIRD and GIRARD.

Eutainia haydenii, et cooperi, KENNICOTT.

? *Coluber ordinatus*, LINNÆUS.

? *Tropidopnotus ordinatus*, HOLBROOK, PUTNAM, GUNTHER.

Eutainia ordinata, BAIRD and GIRARD.

? *Eutainia radix*, BAIRD and GIRARD.

Body moderately strong; general color above black or dark-brown, with a vertebral and two lateral stripes of yellow; abdomen greenish-white, often with black spots upon the sides; under jaw and gular region yellowish-white to greenish-yellow; vertebral and lateral bands begin at the posterior of the head and become insensibly lost upon the tail; occipital plates often with two small yellow spots; ante- and postorbitals, labials, and lower half of rostral yellowish-green; nasals two; upper labials seven or eight, lower eight or nine; inframaxillaries reaching to sixth lower labial; dorsal scales strongly carinated, in 19 rows; gastrosteges, 137-170; urosteges, 55-80 lateral stripe upon the second and third rows of scales; vertebral band about the width of a scale, though situated upon one and two half rows, color below the lateral stripe somewhat lighter than above; tail one-fourth of total length. Length, $2\frac{1}{2}$ feet; head, $1\frac{1}{4}$ inches; tail, $5\frac{1}{4}$ inches; transverse diameter of head, $\frac{1}{4}$ inch; of neck, $\frac{3}{8}$ inch; circumference of body 3 inches.

Habitat, Maine to Virginia, South Carolina, Georgia, Mississippi, Illinois, Oregon, Minnesota, Michigan, Isle Royale in Lake Superior, and Lake Winnipeg.

In the State I have specimens from Yellow Springs, Columbus, and Lancaster, though it is common everywhere. Some of the Ohio specimens show a much duller coloration than is ordinarily observed, probably owing to their having been captured a short time prior to the period at which they would shed their skin. A specimen kept by me in confinement changed from such dull to the ordinary bright markings on casting off its epidermis. I have observed a similar fact in regard to the Blue Racer, *Bascanium on constrictor*, and also upon the *Eutania saurita*.

Eutania sirtalis is our commonest snake. They are clumsy and sluggish animals, found in low, marshy, or comparatively dry places, take to water readily, and when irritated, elevate their scales, giving the body a roughened appearance, and when handled exude a very disagreeable and offensive odor. After swallowing a frog, if one seize the animal by the tail and pass the foot along its back, it can be made to disgorge, and the frog escape in a living condition.

They are popularly believed to swallow their young to shield the latter from danger; in fact unscientific observers report having cut them open and found the little ones within, a fact which can be readily accounted for when it is remembered that this genus brings forth its young alive, and the parties observing undoubtedly saw them in the ovaries rather than in the stomach. Possibly a similar mode of reproduction obtains in other species reported to swallow their young; or the fact that some snakes prey upon others may explain the origin of such reports.

The Garter Snake takes to water quite readily, and retires to winter quarters in October, and issues forth again the following spring, in May.

Occasionally owing to open or very mild weather they re-appear, for a few days at a time, earlier, and then seem to again hibernate. They are gregarious in winter quarters, having been frequently ploughed up in bunches, are sometimes found under peat, and in company with rattlesnakes. Dr. Kirtland reports that they are eaten by hawks, owls, swine, and in some instances, by fowls, ducks, and turkeys. The females in July and August are usually found pregnant with from twenty-five to forty young, and in September and October the sexes have been seen in copulation.

Var. *dorsalis*, Baird and Girard, has a broader vertebral stripe, margined on each side for one scale in width with black, as are also the sides of the abdominal scutellæ and upper basal edge of the scales in the exterior dorsal row; a row of spots above the lateral stripe, and the outer row of dorsal scales acutely emarginate.

Var. *parietalis*, Baird and Girard, has a moderately broad dorsal stripe, and the spaces about and between the lateral dark spots brick red. It is probably extralimital, ranging from Indiana to Texas and West.

Var. *radix*, Baird and Girard, has the scales rough, the outer row broad, the stripes narrow, the lateral ones being less than a scale in width though situated upon two rows, often upon the third and fourth, and has six series of distinct black spots. It is extralimital, ranging from Illinois and Wisconsin, to Minnesota, Dakota, Oregon, and Washington Territory.

Another variety occurring in the State is characterized by the entire absence of the dorsal stripe, it might appropriately be called *melanota*.

GENUS REGINA. Baird and Girard.

Body rather slender; size moderately small; teeth isodont; cephalic plates normal; anteorbitals two or one; postorbitals two, sometimes three; labials and inframaxillaries moderate; nasals one or two; loreal present; prefrontals two; dorsal scales carinated in 19-21 rows; gastrosteges 130-164; urosteges 50-85, all divided; post-abdominal scutella bifid; general color light beneath, dark above, usually with longitudinal bands; habits mostly aquatic; reproduction ovoviviparous.

Anteorbitals two. *a*.

Anteorbitals one. R. KIRTLANDII.

a. Vertical plate as broad at posterior edge of superciliaries as in front. *b*.

a. Vertical plate less broad at posterior edge of superciliaries than in front; extralimital; Texas. R. CLARKII.

b. Abdomen unicolor or with bands. *c*.

b. Abdomen with two series of black spots; extralimital; Pennsylvania and South. R. RIGIDA.

c. Vertical plate notched upon the sides to receive the projecting angle of the superciliaries. R. GRAHAMI.

c. Sides of vertical plate not notched. R. LEBERIS.

REGINA LEBERIS Linnæus.

Yellow-bellied or Leather Snake.

Coluber leberis, LINNÆUS, GMELIN, KALM, SHAW, DAUDIN.

Coluber septemvittatum, SAY, HARLAN.

Tropidonotus leberis, HOLBROOK, DEKAY, DUMERIL and BIBRON, GUNTHER, COPE.

Regina leberis, BAIRD and GIRARD.

Color olive-brown above, beneath yellow, with four longitudinal bands of greenish-brown, of these bands the two inner at times looking somewhat like series of dots; the yellow upon the sides appears as bands above the brown; sides of vertical plates parallel, the plate itself being hexagonal, with the posterior apex more acute than the anterior; anteorbitals two; upper labials seven, lower eight; inframaxillaries reaching to the end of the sixth lower labial; postorbitals over the fourth and fifth upper labials; dorsal scales 19; gastrosteges 140-150; urosteges 65-80; yellow bands upon the sides on first and second rows of scales; tail moderately long, becoming unicolor by the confluence of the lines. Length, 22 inches; head, $\frac{3}{4}$ inch; tail, $5\frac{1}{2}$ inches; transverse diameter of head, $\frac{1}{2}$ inch; of neck, 7-16 inch; circumference of body, $1\frac{1}{2}$ inches.

Habitat, New York, New Jersey, Pennsylvania, Maryland, Virginia, Tennessee, Michigan, Ohio, and Illinois.

In the State I have specimens from Highland county, and also from Columbus. It is aquatic, and probably occurs elsewhere, though it is not very common.

REGINA KIRTLANDII Kennicott.

Little Red Snake.

Regina kirtlandii, KENNICOTT, Proc. Acad. Nat. Sci. Phil., 1865. p. 75.

Tropidoclonion kirtlandii, COPE, Proc. Acad. Nat. Sci. Phil., 1860, p. 340.

General color above purplish brown, with four rows of sub-circular to triangular blotches, the outer larger than the inner, being from two to five scales in width; *color beneath brick red*, with a well defined series of dark blotches near the exterior of the scutellæ; dorsal scales in 19 rows, all carinate; vertical plate hexagonal, the posterior angle more acute, the sides nearly parallel; anteorbitals one on each side; nasals one, with an indented line giving it the appearance of two; upper labials six, lower seven; postorbitals above the fourth upper labials, and inframaxillaries reaching to sixth lower labials; gastrosteges 120-135; urosteges 55-60; post-abdominal scutella bifid. Length $17\frac{1}{2}$ inches; head, $\frac{3}{4}$ inch; tail, $4\frac{1}{2}$ inches; transverse diameter of head, 5-16 inch; of neck $\frac{1}{2}$ inch; circumference of body, $1\frac{1}{2}$ inches.

Habitat, New Jersey, Ohio, Michigan, and Illinois.

Regina kirtlandii is a terrestrial animal, being found in woods, generally under old logs. It is sluggish, not very pugnacious, and in the State has been detected in Columbus.

In naming this species, Mr. Kennicott pays the following compliment to the Ohio Herpetologist: "In giving to this serpent the name

of Dr. Kirtland, as a slight token of the respect due him to whose enthusiastic and untiring devotion to Science the West owes so much, I would also make some expression of my personal gratitude to the honored teacher, whose kind encouragement and instruction led me to study Nature, by dedicating to him his pupil's first contribution to Science."

GENUS TROPIDONOTUS. Kuhl.

Body thick and stout; size large; cephalic plates normal; anteorbitals one, sometimes two; postorbitals three, rarely two; labials and inframaxillaries large; nasals two; loreal present; prefrontals two; dorsal scales in 23-29 rows, carinated; gastrosteges 130-155; urosteges 65-85 all divided; postabdominal scutella bifid; general color three to five series of dark blotches upon a lighter ground; habits aquatic; reproduction ovoviviparous.

Dorsal scales in 23, rarely 25 rows. *a.*

Dorsal scales in 25 rows; upper labials 9, lower 11; extralimal. . . T. WOODHOUSII.

Dorsal scales in 27 rows. T. RHOMBIFER.

Dorsal scales in 29 rows; extralimal, North Carolina to Georgia. . . T. TAXISPILOTA.

a. Abdomen usually spotted with dark. *b.*

a. Abdomen unicolor. *c.*

b. Gastrosteges 137-145. T. SIPEDON.

b. Gastrosteges 128-133. T. FASCIATUS.

c. Anteorbitals one or two. T. ERYTHROGASTER.

TROPIDONOTUS SIPEDON Linnæus.

Water Snake or Water Adder.

Coluber sipedon, LINNÆUS, SHAW, MERREM, HARLAN, KIRTLAND, STORER.

Tropidonotus sipedon, HOLBROOK, DEKAY, DUMERIL and BIBRON, VERRILL.

Coluber pædogaster, WIED.

REGINA GRAHAMII Baird and Girard.

Graham's Snake.

Tropidonotus grahami, GUNTHER, COPE, JORDAN.

Regina grahamii, BAIRD and GIRARD.

General color above brown, with a light vertebral line margined with black; lateral line yellow, with a black margin situated upon the first, second, and third rows of scales; abdomen yellowish, without spots; vertical plates nearly pentagonal, with the sides notched a little behind the center; anteorbitals two; nasals one; upper labials seven, lower eight; postorbitals above the line of union of the fourth and fifth upper labials; inframaxillaries reaching to the anterior end of the seventh lower labials; dorsal scales in 19 rows; gastrosteges 160-162; urosteges 57. Length, 20½ inches; head, ⅝ inch; tail, 4 inches; transverse diameter of head, 5-16 inch; of neck, ¼ inch; circumference of body, 1½ inch.

Habitat, Mississippi Valley from Western Mexico, Texas and Louisiana, to Illinois and Michigan.

Although I have no record of this species having been observed in the State, its range is such as to render its occurrence in Ohio probable.

Tropidonotus niger, HOLBROOK.

Nerodia sipedon, et *transversa*, BAIRD and GIRARD.

Tropidonotus fasciatus, var. *sipedon*, GUNTHER.

General color above brownish, with three series of darker, more or less distinct, approximately quadrilateral blotches, the vertebral row much the larger, covering from two to three scales before backwards, and nine to ten scales in width; abdomen yellowish, with dark blotches, or a marbling of yellow and brown; the general color is sometimes in old specimens so predominant as to render the markings obscure; vertical plate pentagonal, nearly or quite as long as commissural line of occipitals, the latter truncate behind; upper labials 8, lower 10; anteorbitals 1; postorbitals 3, over the commissural line of the fifth and sixth upper labials; inframaxillaries reaching to the posterior end of seventh lower labial; dorsal scales in 23, rarely 25, rows; gastrosteges 137-145; urosteges 60-60; body attaining a large size; tail short.

The young of this species show the coloration very decidedly; a light line reaching back from the posterior edge of, and two light spots upon the occipitals; head also variously marked or marbled with lighter. Length, 2½ feet; head, 1½ inches; tail, 7½ inches; transverse diameter of head, ¾ inch; of neck, 9-16 inch; circumference of body 4½ inches.

Habitat, Canada, Maine, Massachusetts, New York, Pennsylvania, Maryland, Virginia, Ohio, Michigan, Illinois, Wisconsin, and Upper Missouri, "Louisiana and Mexico."

In the State, as in the extralimital part of its range, *Tropidonotus sipedon* is the commonest aquatic snake. It may be seen along the shores of ponds, and streams, and upon logs, basking in the sun. It is found only in wet places, and when disturbed takes to water and glides rapidly away. Although a formidable looking animal, the Water Snake is destitute of poison fangs, and perfectly harmless.

TROPIDONOTUS FASCIATUS Linnaeus.

Coluber fasciatus, LINNÆUS, DAUDIN, HOLBROOK.

Coluber porcatus, HARLAN.

Tropidonotus fasciatus, HOLBROOK, DEKAY, DUMERIL and BIBRON, GUNTHER.

Nerodia fasciata, BAIRD and GIRARD.

? *Coluber porcatus*, KIRTLAND.

General color brown above, with transverse dark spots in the young; sides with from 30-38 sub-triangular red patches; abdomen reddish-white, with dark blotches; head broader behind, and more triangular than *Tropidonotus sipedon*; vertical plate pentagonal, broader in front than behind; upper labials 8, lower 9; anteorbitals 1; dorsal scales in 23 rows, the exterior as well as the others carinated; gastrosteges 128-233; urosteges 40-75.

Habitat, South Carolina, Florida, Mississippi, Louisiana, Mexico, Central America.

Dr Kirtland refers the *Coluber porcatus* to Ohio, and states that it is found upon the shores of rivers and creeks, and that it was popularly confounded with *Tropidonotus sipedon*, under the name of Water Snake. I have not seen it from the State, and think owing to its southern range, that his identification was probably erroneous.

TROPIDONOTUS ERYTHROGASTER Shaw.

Red-bellied Water Snake.*Coluber erythrogaster*, SHAW, HOLBROOK.*Tropidonotus erythrogaster*, HOLBROOK, DEKAY, DUMERIL and BIBRON.*Nerodia erythrogaster*, et *agassizii*, BAIRD and GIRARD.

General color bluish to reddish black above, without spots or blotches; beneath coppery red; body attaining a great size; head large, triangular; muzzle obtuse or truncate; vertical, occipital, temporal, and labial shields large, of the latter the sixth and seventh upper, and the fifth and sixth lower the largest; vertical plate pentagonal, broadest in front, about as long as commissural line of occipitals; anteorbitals one; upper labials 8, lower 10; inframaxillaries large, extending to eighth lower labial; dorsal scales in 23 rows, all carinated except the exterior in which it has become obsolete; gastrosteges 150-155; urosteges 67 to 80. Length, 3-11-12 feet; head, $1\frac{3}{4}$ inches; tail, $10\frac{1}{2}$ inches; transverse diameter of head, $1\frac{1}{2}$ inches; of neck, $\frac{3}{4}$ inch; circumference of body, 7 inches.

Habitat, Michigan, Illinois, Kansas, Arkansas and South.

I have never seen *Tropidonotus erythrogaster* from Ohio. Dr. Wheaton informs me that in the vicinity of Columbus a large serpent of this genus, with a coppery belly is not uncommon. It is doubtless this species, in which opinion I am confirmed by the fact that it has been found at Lake Erie, near Brest, Monroe county, Michigan.

GENUS HETERODON. Beauvois.

Size large; neck and body capable of great dilatation by inhalation of air which is afterwards emitted with a peculiar hissing sound, hence the name Blowing Vipers; head short, large, triangular, resembling somewhat the venomous *Crotalidae*; cephalic region covered with large plates, of which the rostral forms a trihedral pyramid, with a promi-

TROPIDONOTUS RHOMBIFER Hallowell.

Holbrook's Water Snake.*Tropidonotus rhombifer*, HALLOWELL, COPE.*Nerodia rhombifer*, et *holbrookii*, BAIRD and GIRARD.

General color brown, with quadrangular black blotches, about 50 in number, from head to end of tail; lateral transverse bars alternating with the preceding; head elongated, slightly swollen at the temples; muzzle truncated; vertical plate elongated, slightly notched on the sides, and its length greater than commissural line of occipital; upper labials 8, lower 10; inframaxillaries reaching about to end of seventh lower labials; dorsal scales in 27 rows, the outer smooth; gastrosteges 142-143; urosteges 63-73. Length, 2 $\frac{3}{4}$ feet; head, $1\frac{1}{2}$ inches; tail, $6\frac{1}{2}$ inches; transverse diameter of head, 10 lines; of neck, 8 lines; circumference of body 3 inches.

Habitat, Michigan, Illinois, Arkansas, and Louisiana.

Probably not in our limits, but its range is such that it may easily extend into Ohio.

nent ridge or keel above; small *infraorbitals*, above the *labials*, continuous with the *ant-orbitals* in front and *postorbitals* behind; *nasals* two; *lorals* one or two; *prefrontals* enclosing an *azygos* plate with or without other small plates along side; *two posterior maxillary teeth* much the longest; *dorsal scales* in 23 to 27 rows, carinated; *gastrosteges* 125-150; *urosteges* 30-58; *post-abdominal scutella*, bifid.

Azygos and *frontals* separated by small plates. a.

Azygos and *frontals* contiguous. H. PLATYRHINUS.

a. *Interfrontal* region with from 4-8 small plates; *extralimital*. . . H. SIMUS.

a. *Interfrontal* region with from 11-15 small plates; *extralimital*. . H. NASICUS.

HETERODON PLATYRHINUS Latreille.

Hog-nose Snake or Spreading Adder.

Coluber heterodon, DAUDIN, SAY, HARLAN.

Heterodon platyrhinus, LATREILLE, HOLBROOK, STORER, KIRTLAND, DEKAY, DUMERIL and BIBRON, GUNTHER, COPE.

Heterodon annulatus, TROOST.

Heterodon platyrhinos, *cognatus*, *niger*, *et atmodes*, BAIRD and GIRARD.

General color light-brown above, with three series of dark blotches varying from quadrate to circular, and becoming half rings upon the tail, alternating with light yellow; a black band crossing the anterior part of the vertical and superciliary plates and posterior half of the *postfrontals*, and continuing through the eye to the angle of the mouth; upper part of the neck and back with the scales between the black spots brown centrally and surrounded with orange-yellow, as can be seen by stretching the skin; under part of tail varying from yellow to flesh-red; abdomen slate color, becoming greenish-yellow under the neck; *inframaxillary* region greenish-white; vertical and superciliary crossed by a greenish band; upper *labials* yellow, eight in number, lower nine; vertical pentagonal, cuneiform, broadest in front, and longer than commissural line of *occipitals*; *superciliaries* broad; *azygos* elongated, acute behind, contiguous with the *prefrontals* and *postfrontals*, reaching to about the middle of the commissural line of the latter; *inframaxillaries* extending to fourth lower labial; *dorsal scales* in 25, rarely 23, rows; *gastrosteges* 125-149; *urosteges* 46-58. Length, $2\frac{3}{4}$ foot; head, $1\frac{1}{2}$ inches; tail, 7 inches; transverse diameter of head, $1\frac{1}{2}$ inches; of neck, 1 inch; circumference of body, $3\frac{1}{2}$ inches.

Habitat, New Hampshire, Massachusetts, New York, Pennsylvania, New Jersey, Virginia, North Carolina, South Carolina, Georgia, Florida, Texas, Tennessee, Illinois, Ohio, Michigan, and "California."

The Hog-nose Snake is occasionally found in the northeastern part of State, and in the Scioto Valley. It is usually met with in sandy soils, and, it is said, also in low, wet meadows. Its breeding has been observed in Georgia in April, but probably is later in our more northern climate. *Heterodon platyrhinus* rejoices in a multitude of common names, such as Spreading, Deaf, and Blowing Adder, Flat-head, Hog-and Buckwheat-nose Snake, Blauser, Blowing, and Sand Viper, etc.

Considerable discussion has been going on lately in the Science News*

*Vol. I, Nos. 1, 2, 3, and 4.

as to the effect of the bite of this *Heterodon*. Dr. Yarrow of Washington, D. C. called attention to it, and also since stated the fact that he had a fine specimen brought to him the past summer, which the slayer called the "Mountain Moccasin," and declared it to be the most venomous of all snakes. A similar belief prevails among the Indians and common people generally. On the other hand, Messrs. H. S. Reynolds, Urbana, Illinois, C. C. Abbott, Trenton, New Jersey, and R. M. W. Gibbs, Kalamazoo, Michigan, state that they had each been bitten by *Heterodon platyrhinus*, and had known it to bite animals without serious results. Mr. H. E. Heighway, Cincinnati, Ohio, states that, while on a scientific expedition last summer, Prof. A. S. Wetherby and six students from Cincinnati University, found under old logs a "Puffing Adder" of the genus *Heterodon*. The Professor picked it up fearlessly, and while preparing to put it into a bottle of alcohol, was bitten upon the thumb, but no attention was paid to the bite, and no harm resulted. On the other hand, it may be stated, that the *Heterodon* has at the posterior end of the maxillary bone two or four teeth, much larger than the others, and resembling fangs in appearance. They are still farther enveloped in a sheath similar to that in the venomous serpents, and separated by a short interval from the ordinary teeth. These teeth are firmly soldered to the bone, and not loosely set in grooves as the ordinary ones. That the animal could use them for the purpose of striking seemed to me impossible, until Prof. Steers informed me of their peculiar power of apparently dislocating their jaw, which may enable them to do so. The question therefore must be settled by observations made upon the actual bite of the animal. These thus far seem to point to its harmless character, and yet it is hardly safe from them to infer positively that the general opinion is wrong, and that naturalists are right. My own impression is that *Heterodon* is harmless, and yet its general appearance, and more especially the shape of its head strikingly resembles that of the venomous reptiles.

HETERODON PLATYRHINUS Latreille.

var. NIGER Catesby.

Black Viper.

Vipera nigra, CATESBY.

Coluber cacodemon, SHAW.

Scytale niger, DAUDIN, HARLAN.

Coluber thraso, HARLAN.

Heterodon niger, TROOST, HOLBROOK, KIRTLAND, BAIRD and GIRARD, DUMERIL and BIBRON, GUNTHER.

This variety differs from the typical *Heterodon platyrhinus* by being of a uniform black or brown above, without spots, and having a slate colored abdomen.

Habitat, Connecticut, Pennsylvania, South Carolina, Georgia, Mississippi, Tennessee. In the State, Dr. Kirtland reports it as having been found at Legionville and the Ohio hills.

The Black Viper is apparently more ferocious than the typical *platyrhinus*. When disturbed it flattens its head, hisses, throws its mouth wide open, giving it the appearance of a dislocated lower jaw (which remains fixed for some time), and darts at the object. If unable thus to frighten away its foes, and is in turn a little roughly treated, such as being pushed with a stick, it will feign death, as was observed by Troost and also by Prof. Steere of Michigan University. The former of these gentlemen was so far deceived that he laid down his snake for a short time, when it made its escape, and was found again with difficulty. He also found in one which he dissected twenty-five oval eggs, each three-quarters of an inch long, and without a calcareous cover.

GENUS PITYOPHIS. Holbrook.

Body rather long and moderately slender; head elongated; teeth equal, smooth; cephalic plates not normal; rostral high, projecting forwards in some species; prefrontals two; *postfrontals* four or five; nasals two; loreal small; anteorbitals one or two; postorbitals three or four; dorsal scales in 25 to 35 rows, middle ones slightly carinated; gastraltes 210-244; urosteges 44-72; post-abdominal scutella entire.

Dorsal scales in 29 rows. P. MELANOLEUCUS.

Dorsal scales in 29 rows; extralimital. P. SAYI.

PITYOPHIS MELANOLEUCUS Daudin.

Pine or Bull Snake.

Coluber melanoleucus, DAUDIN, HARLAN.

Pituophis melanoleucus, HOLBROOK, BAIRD and GIRARD, DUMERIL and BIBRON, GUNTHER, COPE, JORDAN.

General color white to yellowish, with a dorsal series of large chestnut blotches, which are margined with black; abdomen unicolor, with sides irregularly mottled; vertical plate sub-pentagonal; postfrontals four, the internal pair sub-triangular, external polygonal; upper labials 8, lower 14; nostrils two, vertically oblong; rostral convex, projecting forwards and reaching to the internal post-frontals behind; tail about one-seventh of total length; urosteges 60-65; gastraltes 215-230; dorsal scales in 29 rows. Length, 4 feet; tail 8½ inches.

Habitat, New Jersey, South Carolina and Florida, to Ohio.

Rare in the State. Usually, if not always, the Bull Snake is found in pine woods. It lays from seven to twelve eggs in July, and prior to oviposition the female is very irritable. They emit an odor which is believed to be of use in attracting the opposite sex.*

*For habits of this animal see Am. Naturalist, Jan., 1875, p. 1.

GENUS OPHIBOLUS Baird and Girard.

Body moderately elongated; head slightly, if at all, separable from the neck; cephalic plates normal; *vertical very broad*; superciliaries narrow; postfrontals and prefrontals, each a pair, of moderate size; occipitals large; postorbitals two; anteorbitals one; nasal one, with an indented line giving it the appearance of two; labials and infra-maxillaries rather large; dorsal scales in 21-25 rows, smooth, not imbricated; gastrosteges, 180-220; arostege, 44-65; post-abdominal scutella entire or bifid.

† Dorsal scales in 21 or 23 rows; anal plate entire. *a.*

† Dorsal scales in 25 rows; anal plate bifid. O. CALLIGASTER.

a. Gastrosteges, 180-210. *b.*

a. Gastrosteges, 210-225; extralimital, Maryland to Louisiana; east of Alleghanies.

O. GETULUS.

b. Red, with black rings; head red. O. DOLIATUS.

b. Gray, with brown blotches margined with dark; head gray and black.

O. TRIANGULUS.

OPHIBOLUS CALLIGASTER Say.

Say's Chain Snake.

Coluber calligaster, SAY, HARLAN.

Ablates triangulum, var. *calligaster*; *Ophibolus evansii*, KENNICOTT.

Ophibolus calligaster, COPE, JORDAN.

General color above grayish-brown, with a vertebral series of from forty to sixty chocolate to black sub-quadrangular, emarginate blotches, margined with still darker; head greenish-brown, with darker spots; upper labials yellow; lateral blotches alternating with the vertebral series, often not very distinct; abdomen maculated with approximately quadrilateral dark blotches; vertical plate pentagonal, nearly as long as commissural line of occipitals; upper labials, 7-8, lower, 9-11; dorsal scales in 25 rows; anal plate bifid; gastrosteges, 232; arostege, 60-72. Length, 3½ feet; head, 10 lines; tail, 5 inches; transverse diameter of head, 8 lines; of neck, 7 lines; circumference of body, 3 inches.

Habitat, Arkansas, Kansas, Missouri, Illinois, and Ohio.

I am indebted to Prof. Tuttle, of the Ohio State University for the single specimen of this species which I have seen from the State. It came from Lancaster, in Fairfield county.

OPHIBOLUS TRIANGULUS Boie.

Milk Snake.

Coluber triangulum, BOIE.

Coluber eximius, DEKAY, HARLAN, HOLBROOK, KIRTLAND, STORER, GUNTHER.

Coluber guttatus, SCHLEGEL.

Ophibolus eximius, et *clericus*, BAIRD and GIRARD.

Ablates triangulum, DUMERIL and BIBRON, var. *clericus*, et *eximius*, HALLOWELL.

Lampropeltis triangula, et *Ophibolus doliatus*, sub-species *triangulus*, COPE.

Lampropeltis triangula, VERRILL.

General color grayish white; a vertebral series of transversely elliptical, brown margined with black blotches extends from the neck to the tail, each blotch covering from four to five scales in length and fifteen to twenty in width; lateral spots of the same color in two rows on each side, each spot from three to four scales in width and two to three in length, with smaller spots between; ventral spots quadrangular on one, two, and sometimes three scutellæ, longest transversely; the white upon the back arranged somewhat in transverse bands about one and a half to two scales in width; head with two elliptical blotches reaching from the occipitals backwards, that on the left side the larger, causing the white or creamy-white on the neck above to appear as a longitudinal band between the blotches, and this band bifurcates just behind the occipitals; a dingy white spot on the anterior of the occipitals surrounded by a sub-quadrangular spot of black or brown; a transverse dark band crossing the vertical and postfrontals just in front of the eye; a longitudinal brown blotch running from the eye backward and forward; eyes moderate; pupils black; irides red; vertical plate nearly an equilateral triangle; occipitals rather large, truncate behind; upper labials, 7, lower, 8; infra-maxillaries reaching to posterior end of fifth lower labial; dorsal scales in 21 rows: gastrasteges, 200-210; urosteges, 48-55. Length, $3\frac{1}{2}$ feet; head, $1\frac{1}{2}$ inches; tail, $5\frac{3}{4}$ inches; transverse diameter of head, $\frac{3}{4}$ inch; of neck, $\frac{5}{8}$ inch; circumference of body $3\frac{1}{4}$ inches.

Habitat, Canada, Maine, Massachusetts, Rhode Island, New York, Pennsylvania, Maryland, Ohio, Michigan, Wisconsin and Iowa.

Common in all parts of the State.

The Museum of Michigan University contains a double-headed *O. triangulus*, of which the remainder of the body appears to be perfectly normal. Another case is recorded by Prof. Wyman* of a *Tropidonotus sipedon* with two heads and two tails, and a similar case as well as an instance of a five legged frog is reported by Mr. Kingsley.† Mr. Ryder‡ also calls attention to a specimen of *Rana palustris* with five limbs or rather an additional pair of hind legs fused together. This limb had six toes, and its digital formula might be written 5, 4, 3, 3, 4, 5, and the outer or dark colors prevailed just as they should in case of two limbs united. Cases of monstrosities among serpents have been observed by various parties from the time of Aristotle and Redi to the present, and they, as well as the occurrence of monsters in general, may be due to shock.

The Milk Snake called also Chicken Snake, Thunder and Lightning Snake, Chequered or Spotted Adder, is found in dry woods and frequently also in outhouses and dairies, which it is said to visit in order to get at the milk. It is a perfectly harmless animal, climbs readily and glides with grace and rapidity over smooth places.

Mr. C. Hart Merriam§ on the authority of Mr. John M. Howey, of Canandaigua, N. Y., gives an instance of an *Ophibolus* (probably this

*Proc. Bost. Soc. Nat. Hist., vol. ix, p. 183.

†Am. Naturalist, vol. xii, p. 394-751.

‡Science News, Dec., 15, 1878, p. 69.

species) swallowing an *Eutania* or Striped Snake. He (Howey) struck the snake with the scythe, cutting it in two about three inches from its head, when to his surprise a tail stuck out. He drew it out, and then discovered it to be an *Eutania*, about two-thirds as long as the *Ophibolus*. It had, of course, been swallowed head foremost, and the head was nearly digested.

OPHIBOLUS DOLIATUS Linnæus.

Red or Corn Snake.

Coluber doliatus, LINNÆUS, GMELIN, HARLAN.

Coluber coccineus, BLUMENBACH, KIRTLAND.

Coronella coccinea, SCHLEGEL.

Coronella doliata, HOLBROOK, GUNTHER.

Ophibolus doliatus, et *gentilis*, BAIRD and GIRARD.

Lampropeltis doliata, et *Ophibolus doliatus*, COPE.

Rhinostoma coccinea, BAIRD and GIRARD.

General color red, with from twenty-two to twenty-five pairs of transverse black bands, each inclosing a yellow spot; head in front red, with a black ring on posterior of occipitals, passing forward on each side across the supercillaries and vertical to meet on the postfrontals, thus inclosing a large nearly triangular spot with the apex anteriorly; a black spot upon the sides of the head, upon the temporals and posterior upper labials; abdomen red with dark spots; vertical plate nearly an equilateral triangle; upper labials, 7, lower, 8; infamaxillaries reaching to posterior edge of fifth lower labial; dorsal scales in 21 or 23 rows; gastrosteges, 185-208; urosteges, 45-50. Length, $2\frac{1}{2}$ feet; head, $\frac{3}{4}$ inch; tail, $3\frac{1}{4}$ inches; transverse diameter of head, 6 lines; of neck, 5 lines; circumference of body, 2 inches.

Habitat, Delaware, Maryland, Mississippi, Arkansas, Kansas, and Illinois.

Dr. Kirtland mentions having had a specimen sent to him labelled by Mr. Dorfeuille, which was said to have been taken in Ohio. It is accordingly inserted here, though it must be rare in the State.

GENUS COLUBER. Linnæus.

Scotophis, BAIRD and GIRARD.

Body large, attaining a length of four or five feet; head elongated; vertical plate large and very broad; postfrontals attaining a great size; prefrontals two, large; rostral large, not projecting; nasals two; loreal present; anteorbitals one; postorbitals two; upper and lower labials large; mouth deeply cleft; dorsal scales in 23 to 29 rows, the middle ones slightly crenated, the outer smooth; gastrosteges, 200-235; urosteges, 65-93; post-abdominal scutella bifid.

*Dorsal scales in 25 rows. *a*.

*Dorsal scales in 27, rarely 25 rows. *b*.

*Dorsal scales in 29 rows. *d*.

a. Gastrosteges, 200-210; tail at anus, large, tapering rapidly to a point.

C. VULPINUS.

- a. *Gastrosteges*, 230-240; tail at anus moderate, tapering gradually to a point; extralimital, South Carolina, Louisiana, and Missouri. *C. CONFINIS*.
- b. Dorsal region greenish-yellow, with four longitudinal brown bands; extralimital, North Carolina to Florida. *C. QUADRIVITTATUS*.
- b. Dorsal region without bands. c.
- c. *Gastrosteges*, 230-235; vertical plate longer than broad; black above.
C. OBSOLETUS.
- c. *Gastrosteges*, 210-230; vertical plate about as long as broad; red dorsal blotches; extralimital, Virginia, South Carolina, Georgia, Florida, to Mississippi.
C. GUTTATUS.
- d. Vertical plate about as long as broad; extralimital, Texas to Arkansas.
C. LINDHEIMERI.
- d. Vertical plate longer than broad; extralimital, Texas, Arkansas, Kansas, and Illinois. *C. EMORYI*.

COLUBER OBSOLETUS Say.

Pilot Black Snake or Racer.

Coluber obsoletus, SAY, HOLBROOK, KIRTLAND.

Coluber obsoletus, *et alleghaniensis*, DEKAY.

Scotophis alleghaniensis, BAIRD and GIRARD.

Elaphis alleghaniensis, ALLEN.

Coluber obsoletus, *et Scotophis alleghaniensis*, COPE.

Color black, sometimes with the scales margined with yellowish-white, giving the appearance of lighter blotches; head black above; upper labials greenish-yellow; abdomen dark or a mottled black and yellow, or black and white; gular and lower maxillary region either mottled or dirty yellow; vertical plate sub-pentagonal, longer than broad; occipitals large, truncate behind; postfrontals and rostral large; upper labials, 8, the two posterior the largest, lower, 11, fifth and sixth largest; inframaxillaries extending to eighth lowerlabial; dorsal scales in 27, rarely 25 rows; *gastrosteges*, 230-235; *urosteges*, 80-86. Length, 5 feet; head, $1\frac{1}{2}$ inches; tail, 10 inches; transverse diameter of head, 1 inch; of neck, 9 lines; circumference of body, $4\frac{1}{2}$ inches.

Habitat, Massachusetts, Connecticut, New York, Pennsylvania, Virginia, North Carolina, South Carolina, Ohio, Michigan, Illinois, Missouri, and Arkansas.

In the State I have seen but one specimen of the Pilot Snake. It came from Yellow Springs, Clarke county, and was sent to me by Prof. Tuttle, of the Ohio State University. It differed from the typical *Coluber obsoletus* by having 25 instead of 27 rows of scales, and a slightly broader vertical plate, approaching in these respects the southern variety, *confinis*. It is said to dwell for the most part in damp places, crawling upon the hills in autumn previous to hibernation, and is an animal of "prodigious velocity," probably rare in our limits. It resembles and is liable to be confounded with the Blue Racer, *Basiliscus constrictor*, from which it can be readily distinguished by its darker color, and having the central dorsal scales carinated instead of smooth.

GENUS BASCANION. Baird and Girard.

Body elongated, attaining a length of five or six feet; head elongated, passing gradually into the neck; vertical plate elongated; superciliaries wide; occipitals large; postfrontals moderately large; postorbitals two; anteorbitals two; loreal large; nasals two; labials large; inframaxillaries well developed; mouth deeply cleft; dorsal scales in 17, rarely 19 rows, all smooth; gastrosteges, 170-210; urosteges, 80-110; anal plate bifid; color above black, olive, or blue.

BASCANION CONSTRICTOR Linnaeus.

Blue Racer or Black Snake.

Coluber constrictor, LINNÆUS, GMELIN, HARLAN, SCHLEGEL, STORER HOLBROOK, THOMPSON, KIRTLAND, DEKAY.

Hierophis constrictor, BONAPARTE.

Coryphodon constrictor, DUMERIL and BIBRON, GUNTHER.

Bascanion constrictor, BAIRD and GIRARD, ALLEN, COPE, JORDAN.

? *Bascanion foxii*, BAIRD and GIRARD.

? *Coluber flaviventris*, SAY, HARLAN, HOLBROOK.

? *Bascanion flaviventris*, BAIRD and GIRARD.

General color above in our specimens, varying from uniform azure blue to blue-black; below greenish-blue; gular region, lower jaw, labial, and rostral region of upper jaw whitish; a light line passing from the rostral just above the loreal and eye, to the anterior edge of the superciliaries; vertical plate pentagonal, with irregular sides, broadest anteriorly, in length about equal to commissural line of occipitals; upper

COLUBER VULPINUS Baird and Girard.

Fox Snake.

Scotophis vulpinus, BAIRD and GIRARD.

Coluber vulpinus, COPE.

Elaphis spiloides, DUMERIL and BIBRON.

Coluber spiloides, GUNTHER.

General color above light-brown, with a vertebral and two lateral rows of chocolate colored blotches, the vertebral very large, covering from five to nine scales in length and about twelve in width, the lateral much smaller, about three scales in length and from three to five in width; these blotches extending upon the tail, but smaller; head light-brown to yellow; abdomen with four series of approximately quadrilateral black blotches; vertical plate nearly an equilateral triangle; occipitals large, rounded behind; upper labials, 8, the sixth and seventh largest, lower, 11, the fifth much the largest; inframaxillaries reaching to the sixth lower labial; dorsal scales in 25 rows; gastrosteges, 300-310; urosteges, 65-70; tail large at base. Length, 5 feet; head, 1½ inches; tail, 9¼ inches; transverse diameter of head, 1½ inches; of neck, 10 lines; circumference of body, 5 inches.

Habitat. Massachusetts, New York, Michigan, Wisconsin, Illinois, Kansas, Minnesota.

Although this species has not yet, so far as I know, been observed in Ohio, its range is such as to render its occurrence in the northern part of the State very probable.

labials, 7, lower, 9; inframaxillaries extending to sixth lower labial; temporal region covered with two rows of plates, three or four in each; rostral large, triangular, projecting between the prefrontals; dorsal scales in 17, rarely 19 rows; gastrosteges, 175-190; nosteges, 80-110. Length, 6 feet; head, 1½ inches; tail, 1½ inches; transverse diameter of head, 1 inch; of neck, ¾ inch; circumference of body, 5 inches.

Habitat, Canada, Massachusetts, New York, Pennsylvania, Maryland, North Carolina, South Carolina, Georgia, Florida, Mississippi, Louisiana, Tennessee, Illinois, Indiana, Michigan, and Ohio. "St. Domingo."

From the State I have seen specimens from London and Lancaster, and the portion adjoining Michigan, though it is probably moderately common everywhere. Dr. Kirtland observed that it seemed to be upon the increase, as the State became cleared.

The western Blue Racer differs very markedly in color from the Black Snake of the east. In the latter the color is a lustrous pitch black, while in ours, in the adult state, it is a light azure, and a very pale blue or almost white beneath. The scales in our serpents are somewhat broader than in any of the eastern specimens which I have seen. These differences are sufficient to constitute what Prof. Cope calls a "sub-species" or geographical variety, to which the name *cæruleus* may very properly be applied.

The Blue Racers are gregarious animals during hybernation and in spring, having been ploughed up in bunches of seventy to eighty, but in summer they seem to be solitary, as they are then found singly or in pairs, a male and female being together. They inhabit woods, are sometimes found under and around barns, and climb trees and bushes in order to reach birds' nests, and obtain the young birds and eggs. They also prey upon mice and frogs, and although non-venomous, are said to pursue an enemy who retreats before them. Allen remarked that in Massachusetts *Bascanion constrictor*, like the field mice, was more numerous some years than others, possibly the result of the same cause in both instances, viz. the relative degree to which the ground was protected by snow during winter. The same gentleman saw one alive during a break in the cold weather on January 29, 1864.

GENUS LIOPELTIS. Fitzinger.

Body long and slender; head elongated; teeth equal, smooth; cephalic plates normal; postfrontals and prefrontals each a pair; postorbitals two; anteorbitals one or two; nasals one; loreal present, occasionally fused with the nasal; occipitals large; mouth deeply cleft; dorsal scales in 15 rows, all smooth; gastrosteges, 129-140; anal plate bifid.

LIOPELTIS VERNALIS DeKay.

Green or Grass Snake.

Coluber vernalis, DEKAY, HARLAN, STORER, KIRTLAND, HOLBROOK, THOMPSON.

Chlorosoma vernalis, BAIRD and GIRARD.

Herpetodryas vernalis, HALLOWELL.

Cyclophis vernalis, GUNTHER, COPE.

Liopeitis vernalis, COPE, JORDAN.

Color uniform bright dark-green above; paler beneath, sometimes nearly white; color in alcohol pale-blue; vertical plate elongated pentagonal; rostral large; upper labials, six, lower, eight; eyes large, above the third and fourth upper labials; inframaxillaries reaching to the sixth lower labial; gastrosteges, 129-140; urosteges, 70-95. Length, $1\frac{1}{2}$ feet; head, $\frac{3}{4}$ inch; tail, $4\frac{3}{4}$ inches; transverse diameter of head, 5 lines; of neck, 4 lines; circumference of body, $1\frac{1}{2}$ inches.

Habitat, Maine, Massachusetts, Rhode Island, New York, Pennsylvania, New Jersey, Ohio, Michigan, Illinois, Nebraska, Montana and Colorado, to Florida and New Mexico.

This beautiful little snake frequents marshes, is quick and lively in its movements, and is occasionally found in every part of Ohio.

GENUS CYCLOPHIS. Günther.

Body long and slender; head moderately large; teeth equal, smooth: eye rather large; cephalic plates normal; postfrontals and prefrontals each a pair; postorbitals two; anteorbitals one; nasals one; loreal present; occipitals large; vertical elongated; inframaxillaries long; dorsal scales sub-elliptical, in 17 rows, carinated; gastrosteges, 155-165; urosteges, 110-135; anal plate bifid.

CYCLOPHIS ÆSTIVUS Linnæus.

Summer Green Snake.

Coluber æstivus, LINNÆUS, HARLAN.

Leptophis æstivus, BELL, HOLBROOK.

Herpetodryas æstivus, SCHLEGEL, DUMERIL and BIBRON, HALLOWELL.

Anguis viridis, CATESBY.

Cyclophis æstivus, GUNTHER, COPE, JORDAN.

Ophedrys æstivus, FITZINGER, COPE.

Leptophis æstivus, et majalis, BAIRD and GIRARD.

General color above reddish-green, in alcohol changing to blue; beneath yellowish to greenish-white; upper labials and lower jaw for the most part white; vertical plate sub-pentagonal, longer than broad, but not equal to commissural line of occipitals; upper labials, 7, lower, 8; mouth deeply cleft; commissure curved; eye over third and fourth upper labial; inframaxillaries extending to seventh lower labial; scales in 17 rows, all carinated except the three outer; gastrosteges, 155-158; urosteges, 125-135. Length, 25 inches; head, 8 lines; tail, 11 inches; transverse diameter of head, 4 lines; of neck, 3 lines; circumference of body, 15 lines.

Habitat, Massachusetts?, Pennsylvania, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Mississippi, Louisiana, Texas, New Mexico, Arkansas, Ohio, Illinois, Missouri, "California, Michigan, West Indies."

A single specimen of this beautiful little serpent was sent to me by Prof. Tuttle, of the Ohio State University. It was captured at Ironton, Lawrence county, and is likely to be confounded with the preceding species, from which its seventeen rows of carinated scales at once distinguish it. Prof. Cope found that in confinement "instead of climbing over caladia, ferns, etc., it lived mostly under ground. It had a curious habit of projecting its head, and two or three inches of its body above the ground, and holding them for hours rigidly in a fixed attitude." In this position its resemblance to a small sprout or plant might easily lead to its being mistaken for such, or overlooked by other animals.

GENUS DIADOPHIS. Baird and Girard.

Body slender, elongated; head rather short and broad; teeth equal, smooth; cephalic plates normal; postfrontals and prefrontals each a pair; loreal present; nasals two; postorbitals two; labials and inframaxillaries rather small; occipitals of fair size; rostral comparatively small, not projecting; dorsal scales in 15-17 rows; gastrosteges, 142-240; urosteges, 35-60; anal plate bifid; occipital region generally with a yellowish-ring.

Dorsal scales in 15 rows.

D. PUNCTATUS.

Dorsal scales in 17 rows; abdomen spotted and mottled with black; extralimital.

D. ARNYI.

DIADOPHIS PUNCTATUS Linnaeus.

Ring-necked Snake.

Coluber punctatus, LINNÆUS, GMELIN, HARLAN, KIRTLAND, STORER, HOLBROOK, DEKAY.

Coluber torquatus, SHAW.

Natrix edwardsii, et punctatus, MERREM.

Homalosoma punctatum, WAGLER.

Spiletes punctatus, SWAINSON.

Calamaria punctata, SCHLEGEL.

Ablabes punctatus DUMERIL and BIBRON, GUNTHER, HALLOWELL,

Diadophis punctatus, BAIRD and GIRARD, COPE, VERRILL, ALLEN, JORDAN.

General color above bluish to brownish-black, without spots; a yellow transverse band in the occipital region, sometimes this ring is replaced by yellow spots transversely arranged; beneath orange colored to whitish, either uniform or with a medial row of spots; labial region yellowish-white; vertical plate nearly triangular, not as long as commissural line of occipitals; upper labials, 8, lower, 9; occipitals long and not truncate behind; inframaxillaries reaching to sixth lower labial; eye above the fourth and fifth upper labials; dorsal scales in 15 rows; gastrosteges, 145-163; urosteges, 35-56. Length, 15 inches; head, 6 lines; tail, 3 inches; transverse diameter of head, $3\frac{1}{2}$ lines; of neck, $2\frac{1}{2}$ lines; circumference of body 1 inch.

Habitat, Canada, Maine, Massachusetts, New York, Pennsylvania, North Carolina, South Carolina, Georgia, Florida, Mississippi, Louisiana; north to Ohio and Michigan, and west to the plains.

The Ring-necked Snake is occasionally found in Ohio, but it is rare. It occurs under stones, but more commonly under the bark of decayed trees, and, like the *Eutainia*, when handled, emits a strong and disagreeable odor.

Var. *amabilis*, Baird and Girard, may be distinguished from the above by having the eye over the third and fourth labials, the abdomen crowded with black spots, and a narrow occipital ring. It ranges from California to Texas and eastward as far as our limits, being occasionally found in Ohio.

GENUS STORERIA. Baird and Girard.

Body small; head rather short, easily separable from the neck; teeth smooth and equal; cephalic region covered with plates; loreal absent, rarely present; postfrontals and prefrontals each a pair; nasals two; anteorbitals one or two; postorbitals two; occipitals large; labials and inframaxillaries of good size; rostral rather small; dorsal scales in 15-17 rows, carinated; gastrosteges, 120-140; urosteges, 40-55; anal plate bitid; ovoviparous.

Anteorbitals one; dorsal scales in 17 rows. S. DEKAYI.

Anteorbitals two; dorsal scales in 15 rows. S. OCCIPITO-MACULATA.

STORERIA DEKAYI Holbrook.

Little Brown Snake.

Coluber dekayi, HOLBROOK.

Coluber ordinatus, LINNÆUS, STORER.

Tropidonotus dekayi, HOLBROOK, DEKAY.

Storeria dekayi, BAIRD and GIRARD, COPE, JORDAN.

Ischnognathus dekayi, DUMERIL and BIBRON, GUNTHER.

General color above grayish-brown, with a somewhat lighter vertebral band margined by dotted lines; a black bar extending from the occipitals to the angle of the mouth; two black spots below the eye; abdomen and under parts greenish to grayish white; vertical plate broad, sub-pentagonal, shorter than commissural line of occipitals; *anteorbitals one*; upper and lower labials each seven on a side; inframaxillaries reaching to sixth lower labial; eye small, above the fourth upper labial; *dorsal scales in 17 rows*; gastrosteges, 120-150; urosteges, 40-60. Length, 1 foot; head, $5\frac{1}{2}$ lines; tail, $2\frac{1}{2}$ inches; transverse diameter of head, 3 lines; of neck, 2 lines; circumference of body $2\frac{3}{4}$ inches.

Habitat, Maine, Massachusetts, New York, Pennsylvania, Maryland, South Carolina, Georgia, Mississippi, Louisiana, Texas, Illinois, Ohio, Michigan.

In the State the Little Brown Snake occurs at Cleveland and in north-western and central Ohio, and probably is met with occasionally in all parts. It is an aquatic little animal, feeding upon insects, and perfectly

harmless. An anomaly sometimes occurs in regard to the cephalic plates, as in the case of a specimen before me, which has four postorbitals on one side and two on the other, and also has a couple of labials united.

STORERIA OCCIPITO-MACULATÁ Storer.

Red-bellied Storeria.

Coluber occipito-maculata, STORER.

Coluber venustus, HALLOWELL.

Storeria occipito-maculata, BAIRD and GIRARD, COPE, JORDAN.

Ichnognathus occipito-maculata, GUNTHER.

General color above grayish to dark-brown, with at times dark spots arranged in longitudinal band; *three light spots in the nuchal region*; beneath red or salmon-color to white, sometimes with red upon the flanks and white between; vertical plate sub-pentagonal, longer than broad, nearly or quite equal to commissural line of occipitals; *anteorbitals two*; nostril in the anterior nasal; upper labials, 5-6, lower, 6-7, on a side; *dorsal scales in 15 rows*; gastrosteges, 125-130; urosteges, 40-50. Length, 10 inches; head, 4 lines; tail, 2 inches; transverse diameter of head, 2 lines; of neck, $1\frac{1}{2}$ lines; circumference of body 1 inch.

Habitat, Maine, New York, Pennsylvania, South Carolina, Georgia, Kentucky, Illinois, Ohio, Michigan, Wisconsin, Minnesota.

Not rare about Columbus. It is somewhat nocturnal, and lives chiefly under logs and stones.

GENUS CARPHIOPHIS. Gervais.

Body slender, cylindrical, of nearly uniform thickness; head and neck not separable, the former *tapering to a pointed snout*; teeth equal, smooth; vertical plate very broad; superciliaries exceedingly narrow; occipitals moderate; postorbitals one; anteorbitals one; frontals one or two pairs; inframaxillaries small; *dorsal scales in 13 rows*, all smooth; gastrosteges, 120-135; anal plate bifid.

Frontal plates in two pairs. *a.*

Frontal plates a single pair; abdomen flesh-colored; extralimital. . . C. HELENÆ.

a. Color above lustrous purplish-black; abdomen flesh-colored, extending over the third row of scales; extralimital. C. VERMIS.

a. Color above chestnut-brown. C. AMÆNUS.

CARPHOPHIS AMÆNUS Say.

Ground or Worm Snake.

Coluber amœnus, SAY, HARLAN, STORER.

Calamaria amœna, SCHLEGEL.

Brachyorrhos amœnus, HOLBROOK.

Celuta amœna, BAIRD and GIRARD.

Carphophis amœna, GERVAIS, DUMERIL and BIBRON, GUNTHER.

Carphophiops amœnus, COPE, JORDAN.

General color above brown, without spots or bands; beneath salmon-red; head small; vertical plate irregular, hexagonal, pointed behind, about as broad as long, and equal

to commissural line of occipitals; temporal shields well developed; frontal plates in two pairs; nostril in anterior part of nasal plate; rostral rounded anteriorly; loreal quadrilateral, entering the orbit; postorbital rhomboidal; upper labials, five, lower, six; eyes over the third and fourth labial; urosteges, 120-132. Length, 11 inches; head, $4\frac{1}{2}$ lines; tail, $1\frac{1}{2}$ inches; transverse diameter of head, $2\frac{1}{4}$ lines; of neck, $2\frac{1}{4}$ lines; circumference of body, 1 inch.

Habitat, Massachusetts?, New York, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Mississippi, Illinois, Western Missouri, and Ohio.

This species is inserted here upon the authority of Dr. J. M. Wheaton, of Columbus, who informs me that some years ago a specimen was captured by Prof. Tuttle, at Ironton, on the bank of the Ohio river. The animal was sent to the Smithsonian Institution, hence its absence from the collection which that gentleman so kindly placed in my hands. Dr. Wheaton, however, informs me that it had the peculiarity of a single pair of frontals. This would make it correspond, in that respect at least, to *Carphophis helenæ* which is probably only a variety of *O. amœnus*.

The following species of Ophidians, though not yet reported from the State, have such a range as to render their occurrence in our fauna possible:

Farancia abacura, Holb.

BAIRD and GIRARD, Cat., p. 123.

Habitat, South Carolina and Louisiana, and according to Nelson, Illinois.

Abaster erythrogrammus, Daud.

BAIRD and GIRARD, Cat., p. 125.

Habitat, North Carolina and Georgia, to Alabama, and Nelson says, Illinois.

Virginia valeriæ, Baird and Girard.

BAIRD and GIRARD, Cat., p. 127.

Habitat, Maryland and North Carolina, to Illinois.

Virginia elegans, Kenn.

Proc. Acad. Nat. Sci. Phila., 1859, p. 99.

Habitat, Illinois to Arkansas.

Carphophis helenæ, Kenn.

Proc. Acad. Nat. Sci. Phila., 1859, p. 100;

Habitat, Illinois and Tennessee, to Mississippi.

Carphophis vermis, Kenn.

Proc. Acad. Nat. Sci. Phila., 1859, p. 99.

Habitat, Missouri, Kansas.

Ophibolus getulus, var. *sayi*, Holb.

BAIRD and GIRARD, Cat., p. 84.

Habitat, Illinois, Missouri, Arkansas, to Mississippi and Louisiana.

Diadophis arnyi, Kenn.

Proc. Acad. Nat. Sci. Phil., 1859, p. 99.

Habitat, Illinois to Kansas.

Coluber emoryi, Baird and Girard.

Proc. Acad. Nat. Sci. Phil., 1859, p. 98. As *S. calligaster*.

Proc. Acad. Nat. Sci. Phila., 1856, p. 244.

BAIRD and GIRARD, Cat., p. 157.

Habitat, Texas to Arkansas, Kansas, and Illinois.

Pityophis sayi, Schl.

BAIRD and GIRARD, Cat., p. 151.

Habitat, Wisconsin, Illinois, Missouri, Kansas, and Nebraska.

Regina (Microps, Hal.) lineata, Hallowell.

Proc. Acad. Nat. Sci. Phil., 1856, p. 241.

Habitat, Kansas to Texas.

Tropidonotus woodhousii, Baird and Girard.

BAIRD and GIRARD, Cat., p. 59.

Habitat, Texas to Missouri, and Arkansas.

Heterodon simus, Linn.

BAIRD and GIRARD, Cat., p. 59.

Habitat, North Carolina, South Carolina, to Mississippi, Illinois and Wisconsin.

Heterodon nasicus, Baird and Girard.

Proc. Acad. Nat. Sci. Phila., 1856, p. 249.

BAIRD and GIRARD, Cat., p. 59.

U. S. Geolog. Surv., 100th Meridian, v. 611.

Proc. Bost. Soc. Nat. Hist., 1874, p. 69.

Habitat, Mexico, New Mexico, Utah and California, to Kansas, Arkansas, Nebraska and Montana.

AMPHIBIA.*

Metamorphosis after birth; respiration branchial in young, pulmonary or pulmonary and branchial in the adult, but always feeble in the lungs, while active from the skin; lungs with few and coarse celis; blood cold; corpuscles oval, nucleated; circulation incomplete; heart in adult with two auricles and a ventricle†; reproduction oviparous or ovoviparous; foetus anamniote; allantois wanting, unless the urinary bladder represents it‡; skin usually naked or unarmed; skeleton incomplete, internal; cranium with two occipital condyles; nasal sacs and pharynx connected; nervous system cerebro-spinal; brain small; cerebellum scarcely visible; excrementitious and reproductive organs opening into a cloaca.

The living forms are divided into three orders, as follows :

- | | | |
|--|-----------|-------------|
| Fest present, at least in front; body not vermiform. | a. | |
| Fest wanting; body vermiform; extralimital. | | OPIOMORPHA. |
| a. Adult tailless; body short and thick. | | ANOURA. |
| a. Tail always present; body lacertiloid. | | URODELA. |

ORDER ANOURA. TAILLESS AMPHIBIANS.

Metamorphosis complete; young fish-like, herbivorous, with a long intestinal canal; gills external at first; teeth and limbs wanting; adult without branchial arches; body short, depressed, raniform, tailless; feet four, posterior longer; tongue large, fleshy, free posteriorly, and capable of protrusion; ear provided with an eardrum tube; fenestra rotunda present; nasal sacs and pharynx connected; hyoid bone with but one pair of cornua; radius and ulna ankylosed as are also the tibia and fibula; astragalus and calcaneum replaced by two elongated, cylindrical bones; vertebrae ten, without any distinct atlas; ureters opening into the oviducts; fecundation after exclusion of the eggs.

* For the anatomy of these animals, see Brown's *Klassen und Ordnung des Thier-Reiches*, and Duges' *Recherches sur l'Osteologie et la Myologie des Batraciens a leurs differens Ages*.

† A question has been raised in regard to the structure of the heart in the Perenni-branchiata. Proteus, and also the Axolotl in all probability have only a single auricle.

‡ Prof. Wyman, Proc. Boston Soc. Nat. Hist., p. 58, states from his observations that he considers the urinary bladder of frogs to structurally resemble that of fishes and scaly reptiles. From its anatomical relations to the intestine and vascular system he regards it as a rudimentary allantois.

* Maxillary teeth present in the upper jaw. *a.*

* Maxillary teeth wanting. *b.*

a. Tips of toes undilated. *c.*

a. Tips of toes dilated, forming disks. **HYLIDÆ.**

b. Parotoids present; toes palmate. **BUFONIDÆ.**

b. Parotoids none; toes distinct. **ENGYSTOMIDÆ.**

c. Parotoids present. **ALYTIDÆ.**

c. Parotoids none. **RANIDÆ.**

Alytidæ, extralimital, characterized by a stout, toad like body; parotoids present; upper maxillary and vomer dentigerous; tongue rounded, nearly entire, slightly, if at all, free behind; ear perfect; pupil of eye vertical; toes undilated, palmate; sacral diapophyses dilated; vertebræ pro- or opisthocœlian; manubrium cartilaginous, and usually the cuneiform bone developed into a kind of shovel, an adaptation to their fossorial habits, has two North America genera, *Spea* and *Scaphiopus*; the latter, with three species, of which *Scaphiopus holbrookii*, Proc. Acad. Nat. Sci. Phil., 1863, p. 54, and DeKay's Reptiles of N. Y., p. 66, ranges from Massachusetts, Connecticut, New York, Maryland, to South Carolina, Florida, and Mississippi. It digs with celerity and soon buries itself, pairs and oviposits within a few hours after awaking in spring.

Engystomidæ, extralimital, has no maxillary teeth, no parotoid, no epiconoid, but with a perfect ear, undilated distinct toes, and dilated sacral diapophyses, is represented in North America, by one species *Engystoma carolinense*, Holbrook, North American Herp., v. p. 42, which ranges from South Carolina, Georgia, and Florida, to Louisiana, and Mississippi. "Mexico."

FAMILY BUFONIDÆ. THE TOADS.

Posterior foot scarcely as long as the body; fingers four; toes five, palmate and undilated; skin usually warty; parotoids very large; ear perfectly developed; mouth edentulous; tongue large, fleshy, attached in front, entire and free behind, and capable of being used as an instrument of prehension; sacral diapophyses dilated; acromion and scapoid connected by a cartilaginous arch; cuneiform bone usually prolonged into a distinct plantar tubercle; terrestrial and nocturnal.

GENUS BUFO. Laurenti.

Body very rough and warty; head short; crown flat, or with slight ridges; tongue elliptical; snout rounded or truncated; males generally with an internal vocal sac, which communicates with the mouth by two orifices; lateral cutaneous folds wanting; parotoid with distinct pores.

BUFO LENTIGINOSUS Shaw.

American Toad.

Rana terrestris, CATESBY.

Rana musica, LINNÆUS.

Bufo lentiginosus, SHAW, GUNTHER, COPE.

Bufo musicus, LATREILLE, DAUDIN, MERREM, GRAVENHORST.

Telmatobius lentiginosus, LECONTE.

Bufo americanus, HOLBROOK, DEKAY, STORER.

Bufo musicus, et americanus, HARLAN, DUMERIL and BIBRON.

Bufo fowleri, PUTNAM.

Bufo cognatus, SAY.

Bufo frontosus, COPE.

General color above cinereous to dark slate, speckled with whitish-gray and brown; beneath yellowish or dirty white; gular region and under side of legs darker; head small; nostrils vertical, smaller and closer together than the inner nares; eyes moderate; pupil black; irides golden; tympanum small, its color rendering it not very apparent; feet each with two plantar tubercles, the one large and the other small; hind legs obscurely barred with darker; above granulate or speckled over with small warts; forehead with two long ridges swollen behind; very variable, owing to age, season, sex, and will of the animal. Length, $3\frac{1}{2}$ inches; hind limb, $2\frac{1}{2}$ inches; fore limb, $1\frac{1}{2}$ inches; breadth of head, $1\frac{1}{2}$ inches; depth of head, $\frac{5}{8}$ inch; head to axilla, $1\frac{1}{2}$ inches.

The typical *Bufo lentiginosus* is extralimital, having its habitat South Carolina, Florida, Alabama, Mississippi; but our fauna includes var. *americanus*, LeConte, which differs from the above by having the bony ridges moderate and not much swollen behind; the small warts upon the back replaced by much larger ones, and a yellowish vertebral line extending from the occipital region backwards.

Habitat, Labrador, Nova Scotia, Maine, New Hampshire, Massachusetts, Connecticut, New York, Virginia, Michigan, Ohio, Indiana, Illinois, Arkansas, Kansas, Dakota, "Great Bear Lake."

The American Toad, including its varieties, is the analogue of *Bufo vulgaris* of the old world, and, like that species, has a remarkably wide distribution, ranging from the Esquimaux River and Okak, Labrador, to Florida and Texas and Mexico, and north to Dakota and Lake Winnipeg; and Gunther in his catalogue mentions a specimen sent by Sir J. Richardson from the Great Bear Lake. In brief, this genus appears to be almost world wide, with the exception of Australia, in their distribution, and a striking fact is that the Japanese specimens of *Bufo vulgaris* approach more nearly to the American Toad than do the European. They also attain a large size in elevated regions.

Our toad during the day remains in concealment, crouched in cavities under stones, dead or decaying trees, or stumps, and is sometimes in cellars, or drowned in wells. They have been found in the latter situation buried in the mud at the bottom, but still alive, and are supposed to have been interred for some time. They are mild and timid animals, which oviposit in May, and begin to disappear the last of August or forepart of September. Like the frogs, they repair to ponds and hibernate in mud, where they have been found a foot below the surface. Bell states that they eat their skin as soon as cast, and, in Massachusetts, Allen found frogs and toads under stones in an unfrozen spring in February.

Mr. W. K. Higley, of Ann Arbor, Michigan, informs me that he has seen the common American Toad, in April, repair in great numbers to

ponds in order to copulate, the male seizing the female just behind the arms. A short time after he noticed the pond to contain a great number of dead animals, which he explains on the supposition that the males while mounted upon the females, pressed the latter under water so long as to cause death from drowning, and this view was corroborated by his finding, in some cases, the male still clasping the dead female.

FAMILY HYLIDÆ. TREE TOADS.

Head short; parotoids none; tongue attached in front, free and usually notched behind; ear well developed, with a distinct tympanum; maxillary and vomero-palatine teeth present in upper jaw; abdominal integument areolate, or with tubercular granulations; toes palmate, with the tips of the digits dilated, forming disks or pellets; vertebræ procœlian; sacral diapophyses dilated or undilated; arboreal or aquatic.

This family are most abundant in the Neotropical, but absent from the Ethiopian region, and our North American genera may be divided as follows:

*Toes distinct or slightly webbed at base; fingers nearly or quite distinct; disks small. CHOROPHILUS.

*Toes webbed nearly to tips; fingers nearly or quite distinct; disks small. A. A. S.

*Toes prominently webbed; fingers partially palmate; disks large; body often short and thick. HYLÆ.

GENUS CHOROPHILUS. Baird.

Body slender and very delicate, smooth or granulated above; tongue nearly orbicular, emarginate behind; vomerine teeth posterior to or between the inner nares; fingers and toes distinct or with basal web reaching to phalanges; tips slightly dilated; sacral diapophyses expanded; males with a vocal vesicle, vomerine teeth between the inner nares; skin above granulated. C. TRISERIATUS.

Vomerine teeth posterior to inner nares; skin above smooth or warty, not granulated; web entirely wanting between the two outer toes; color above black, with spots or stripes. C. NIGRITUS.

CHOROPHILUS TRISERIATUS Wiedman.

Little Tree Frog.

Hyla triseriatus, MAX. PRINZ VON WIEDMAN.

Helocœtes triseriatus et feriarum, BAIRD.

Chorophilus triseriatus, JORDAN, COPE.

General color above, bluish ash to black, with a vertebral and two lateral lines, often with five distinct stripes in front; spots wanting, or present only upon the head; femur about as long as, or somewhat shorter than, the tibia; toes with a slight trace of web at the base of each; second toe very long, fifth short; hind legs long, about two and a half to three times the anterior; skin granulated above and below, without warts; vomerine teeth in two elevated circular patches, between the inner nares.

Length, 1 inch; hind leg, $1\frac{1}{2}$ inches; head to axilla, 5 lines; transverse diameter of head, $2\frac{1}{2}$ lines; vertical diameter of head, $1\frac{1}{2}$ lines; transverse diameter of body, 3 lines.

Habitat, Pennsylvania, Michigan, Wisconsin, Illinois, New Mexico, Kansas, Nebraska, Colorado, and Dakota.

Rare in Ohio.

GENUS *ACRIS*. Dumeril and Bibron.

Head short and broad; eyes prominent; tongue cordiform; vomerine teeth in two groups, between the inner nares; tympanum scarcely perceptible; skin upon the back smooth or slightly granular; digital disks small; toes webbed almost to tips; fingers nearly or quite distinct; males with an interior subgular vocal sac.

ACRIS GRYLLUS LeConte.

var. CREPITANS Baird.

Cricket Frog.

Rana gryllus, LeConte, Harlan.

Rana dorsalis, Harlan.

Acris gryllus, Dumeril and Bibron, Gunther.

Hyla gryllus, Holbrook.

Hylodes gryllus, Holbrook, DeKay.

Acris crepitans, Baird, LeConte.

Acris gryllus, subgenus, *crepitans*, Cope.

Color above varying from cinereous or brown, often with a triangular dark spot, margined with white in the occipital region; another dark spot, sometimes extending from the axilla backwards, with white on its under side; back often with minute points of black, and frequently with a vertebral stripe; lips usually whitish, speckled with darker; chin and gular region varying from white to yellow; abdomen whitish, often varied with dusky; inner and posterior part of thighs granulated; femur slightly shorter than tibia; second toe longest; posterior limbs three and a half to four times as long as the anterior, the latter with a transverse cutaneous fold across the breast between them.

Length, $1\frac{1}{2}$ inches; head to axilla, 5 lines; hind leg $1\frac{1}{2}$ inches; transverse diameter of head, $4\frac{1}{2}$ lines; vertical diameter of head, 3 lines; transverse diameter of body, $5\frac{1}{2}$ lines.

Habitat, New York, Pennsylvania, Michigan, Ohio, Illinois, Arkansas, Georgia, Florida and Texas.

This is a lively and noisy little aquatic animal, frequenting the grass on the borders of ponds, and never found upon trees.

GENUS *HYLA*. Laurenti.

Head short, not separable from the body, and covered with a soft skin; eyes prominent; vomerine teeth between the nares; toes long and broadly palmate; fingers more or less webbed; digital disks prominent; tongue large, nearly orbicular, entire or slightly emarginate behind; males with one or two sublingual vocal sacs; arboreal in summer; hibernating in mud or old logs; color changeable.

Chorophilus nigrilus. Proc. Acad. Nat. Sci., Phil., 1855, p. 427, Holbrook's N. Am., Herp. IV, p. 107. This animal, which I had supposed to be a Southern species, limited to South Carolina and Georgia, is recorded by Günther, Cat. British Museum, p. 97, under the name of *Pseudacris nigrila*, as coming from the Great Bear Lake. Should this species be found to have so wide a range, it will doubtless yet be found in our limits.

* Patches of vomerine teeth not elevated; tongue truncate or entire behind; reddish to blackish brown, with dark rhomboidal spots and lines, sometimes showing a cruciform arrangement. H. PICKERINGII.

* Patches of vomerines slightly elevated; tongue emarginate behind; color varying from green to brown, with irregular spots. H. VERSICOLOR.

HYLA VERSICOLOR LeConte.

Common Tree Toad.

Hyla versicolor, LeConte, Harlan, Holbrook, Storer, DeKay, Dumeril and Bibron, Gunther, Verrill, Allen, Cope, Jordan.

Hyla verrucosa, DAUDIN.

Dendrohyas versicolor, Tschudi.

Hyla squirrella, STORER, ALLEN, JONES.

Hyla richardii, BAIRD.

General color above varying from green to brown, with irregular darker blotches; dark upon the legs, usually in the form of bars; inframaxillary region as far back as the gular fold, of the same color as the back; skin above rough, with numerous small elevations; abdomen and under part of the thighs whitish to yellow, strongly granulated; femur longer than tibia; tarsus much shorter; toes palmate to the base of the distal phalanges, and these with a web-like expansion on each side; fingers distinctly webbed at base, the fourth appposable to the other three; hind leg two to two and a half times the length of the anterior; tongue very thick and fleshy, slightly notched behind; inner nares more widely separated than the outer; vomerine teeth in two approximately transverse, slightly elevated lines between the inner nares.

Length, $1\frac{1}{2}$ inches; head to axilla, $5\frac{1}{2}$ lines; hind limb, $2\frac{1}{2}$ inches; transverse diameter of head, 7 lines; vertical diameter of head, $4\frac{1}{2}$ lines; transverse diameter of body, $7\frac{1}{2}$ lines.

Habitat, Nova Scotia, Maine, Massachusetts, New York, Pennsylvania, Virginia, Georgia, Louisiana, Tennessee, Ohio, Michigan, "Great Bear Lake, California, and Mexico."

This beautiful little animal is very common in all parts of the State. It has ventriloquial powers, and is especially clamorous in damp weather and towards evening. It is found on trees and old fences, to the color of which it assimilates itself in a striking degree. It has an acrid secretion. In fine weather it climbs the highest trees after insects; and Harlan* records a case of one in winter, dug up at the root of an apple tree several feet under ground. Burroughs† also relates that he has heard them piping late in November in an apple tree, and was quite confident that they hybernated therein. The ground at this time was frozen, and on the first warm day in April he found one in a cavity of the trunk of the tree. It is improbable that it had come from the

* Medical and Physical Researches, p. 109.

† Science News, November 1, 1878, p. 8.

marshes thus early in the season, and he therefore thought that the animal had hybernated in that situation. Whether they spend the winter in mud or old logs, they are found in marshes in early spring, where they lay their eggs. Afterwards, in the latter part of April or in May, they betake themselves to the woods.

The Tree Toad is also reported to be useful as a barometer. It is said that, if they are placed in a tall jar, with a ladder in it, in fair weather they will climb towards the top, but descend on the approach of a storm. How true this may be, not having tried it, I have no means of judging, and shall refrain from expressing any opinion on the subject.

HYLA PICKERINGII Holbrook.

Pickering's Tree Toad.

Hylodes pickeringii, HOLBROOK, STORER, DEKAY.

Hyla pickeringii, LECONTE, COPE, JORDAN.

Color quite variable at the will of the animal: in general, reddish brown to fawn above, with lines and spots or specks of darker, arranged upon the back in the form of a cross; upper lip yellowish; legs above with transverse dark bars; posterior of the body with a dusky blotch; under parts white, with numerous dark spots; gular and inframaxillary region yellowish; dark markings upon the animal often becoming indistinct; eyes large; pupils black; irides golden; tympanum small; nostrils small, nearer the muzzle than the eye; inner nares more widely separated than the outer: a transverse fold of the skin connecting the fore limbs on the under side; body rather slender; hind legs long; femur a trifle shorter than the tibia; thighs granulated beneath.

Length, 1 inch; head to axilla, 10 lines; hind leg, $1\frac{1}{2}$ inches; fore leg, $6\frac{1}{2}$ lines; transverse diameter of head, 4 lines; vertical diameter of head, $2\frac{1}{4}$ lines; transverse diameter of body, 4 $\frac{1}{2}$ lines.

Habitat, Maine, New Hampshire, Vermont, Massachusetts, New York, Pennsylvania, Michigan to Cook county, Illinois.

I have not seen this species from the State, and have included it here solely on the extent of its extralimital range. It is found on bark of dead trees and on leaves, such as Indian corn and grape vines, and in green-houses. It has been observed in Maine to deposit its eggs in water in April, and at other seasons occurred in upland or damp woods among fallen leaves.

FAMILY RANIDÆ. THE FROGS.

Posterior feet much longer than the anterior, in length exceeding the body; fingers four; toes five, simple, undilated at tips and broadly palmate; skin smooth; parotoids none; tongue large, fleshy, attached in front, emarginate and free behind; vomero-palatine teeth present; maxillaries, a single row in the upper jaw; ear well developed; tail in young long and compressed; sacral diapophyses cylindrical; epicoracoid present; cuneiform bone somewhat prolonged, but not forming a spur; animals aquatic in the main, inhabiting every region of the globe.

GENUS RANA. Linnaeus.

Tongue oblong, deeply notched behind, and free posteriorly and laterally; vomerine teeth between the inner nares; eustachian tubes large; tympanum prominent; eyes large; fingers distinct, fourth not opposable to the others; males usually with two lateral vocal sacs.

The eggs in our species are almost mature in the fall, so that animals can and do pair and oviposit in one to two days after awaking from hibernation.

* Dorsal region, with large, distinct spots. *b.*

* Dorsal region, with small spots, or none. *a.*

a. Tympanum small, seven or less millimeters in diameter. *c.*

a. Tympanum usually, eight or more millimeters in diameter, and when smaller, temple without black band, and back not vermiculated with white or yellow. *d.*

b. Males with an internal vocal sac on each side; dorsal spots roundish and usually arranged somewhat irregularly. *R. HALECINA.*

b. Males without vocal sacs; dorsal and lateral spots usually quadrate and arranged in four distinct rows, with other external ones irregular.

R. PALUSTRIS.

c. Temple, with a large black spot. *R. TEMPORARIA.*

c. Temple without such spot; color above, greenish olive, with sinuations or vermiculations of white or yellow; extralimital; New York, Okak, Labrador and Yukon River to Minnesota, Montana and Utah.

R. SEPTENTRIONALIS.

d. Dorso-lateral cutaneous folds distinct. *R. CLAMITANS.*

d. Dorso-lateral cutaneous folds wanting or indistinct, *R. CATESBYANA.*

RANA HALECINA Kalm,

Leopard Frog.

Rana halecina, KALM, DAUDIN, MERREM, HARLAN, TSCHUDI, DUMERIL and BIBRON, HOLBROOK, HALLOWELL, LAURENTI, STORER, DEKAY, ALLEN, COPE, JORDAN, GUNTHER, VERRILL.

Rana pipiens, GMELIN, SHAW, SCHNEIDER, LECONTE.

Rana palustris, GMELIN.

Rana berlandieri, BAIRD.

Rana melanotos, RAFINESQUE.

Rana areolata, BAIRD and GIRARD (?).

Rana capito, LECONTE.

Rana utricularia, HARLAN.

Color above varying from light to dark green or brown; dorsal and lateral spots large, black, often margined with yellow, sub-circular or elongated, quadrate, and often arranged in two, but rarely more, distinct rows, and when in more than two rows, then with spots placed irregularly between; abdomen varying from white to yellow or dusky; legs above with transverse bars or blotches of black, which often have a yellow margin; thighs granulated posteriorly; femur shorter than tibia; toes and fingers, with tubercles at the joints; tympanum, green, about seven millimeters in diameter; vomerine teeth in two, almost circular, slightly elevated patches; inner nares large, more widely separated than the outer; snout rather pointed; nostrils lateral, about midway between

the muzzle and the eye. Length, $3\frac{1}{2}$ inches; head to axilla, $1\frac{1}{2}$ inches; hind leg, $5\frac{1}{2}$ inches; transverse diameter of head, 1 inch; vertical diameter of head, 8 lines; transverse diameter of body, $1\frac{1}{2}$ inches.

Habitat, Nova Scotia to Lake Winnepeg, Maine, Massachusetts, New York, Pennsylvania, South Carolina, Georgia, Mexico, New Mexico, Arizona, Arkansas, Utah, Colorado, Montana, Ohio and Michigan.

Common in all parts of the State.

The Leopard or Shad Frog is usually found in wet places in marshes and upon the borders of streams, though it is said to have been found in summer in fields at a distance from water. They are active animals, very difficult to capture, leaping from eight to ten feet, emit a peeping note, and lay their eggs in April. This is the analogue, and it may be a variety of the European *Rana esculenta*, or Green Frog, which it resembles.

RANA PALUSTRIS LeConte.

Marsh, Pickerel, or Tiger Frog.

Rana palustris, LeConte, Harlan, Holbrook, Dumeril and Bibron, Hallowell, Storer, Kirtland, DeKay, Gunther, Verrill, Allen, Cope, Jordan.

Rana pardalis, Harlan.

Color above light to dark green, with four distinct rows of usually large quadrate, black spots, which at times are confluent, producing the appearance of longitudinal bands; outside of these rows are other spots arranged irregularly; upper part of legs with transverse bars or blotches of black; abdomen and under parts varying from white to orange yellow; thighs granulated posteriorly; femur shorter than tibia; toes and fingers, usually with tubercles at the joints; tympanum green, lighter than the body, and small, from two to four millimeters in diameter; vomerine teeth, in two, nearly circular, slightly elevated patches; inner nares moderate, more distant than the outer; snout roundly pointed; nostrils somewhat nearer the muzzle than the eye; vocal vesicle always wanting; cutaneous folds not prominent. Length, $2\frac{1}{2}$ inches; head to axilla, 11 lines; hind leg, 4 inches; fore leg, $1\frac{1}{2}$ inches; transverse diameter of head, $\frac{1}{2}$ inch; vertical diameter of head, $\frac{5}{8}$ inch; transverse diameter of body, $\frac{7}{8}$ inch.

Habitat, Maine, Massachusetts, New York, Pennsylvania, Virginia, Ohio and Michigan.

The habits of this little animal are very similar to those of *Rana halerina*, and there is considerable doubt in my mind whether it should be retained as a distinct species, and not considered a variety of young *Rana halerina*; while the typical *halerina* differs strikingly from the typical *palustris*, the varieties of these closely approach, if they do not shade into each other.

The Marsh Frog is usually found in the vicinity of ponds and marshes, though occasionally, in the morning, after a heavy dew, it is seen at some distance from water. Its note is a prolonged, grating sound, and its odor strong and offensive.

RANA TEMPORARIA Linnæus.

Rana muta, LAURENTI.*Rana scotica*, BELL.*Rana oxyrhinus*, et *platyrhinus*, STEENSTRUP.*Rana arvalis*, NILSSON.*Rana japonica*, SCHLEGEL.

Habitat, England, Scotland, Germany, and Sweden, to Japan.

*(American Specimens.)**a. var. CANTABRIGENSIS* Baird.

Yellowish-brown above, with a lateral fold, and a vertebral line from snout to anus, light colored; posterior of thigh and leg with a narrow light line.

Habitat, Massachusetts to Rocky Mountains; north of the Great Lakes.

Not yet observed in Ohio.

b. var. SYLVATICA LeConte.**Wood Frog.***Rana sylvatica*, LeConte, HOLBROOK, KIRTLAND, STORER, DeKAY, DUMERIL and BIBRON, ALLEN, VERRELL.*Rana sylvatica*, et *pennsylvanica*, HARLAN.*Rana temporaria*, var. *sylvatica*, GUNTHER, JORDAN.

Color above green to greenish-brown; no vertebral band; lateral cutaneous folds of about the same color as the back; a dark spot passing through the tympanum, eye and usually also the nostril, margined below with white; legs above usually barred or blotched with dark; abdomen cream-colored to white; gular region and under parts of legs yellowish; lower jaw often with darker markings; thighs granulated posteriorly; femur and tibia of nearly equal length, the latter somewhat longer; toes and fingers with tubercles under part of the joints; head small; muzzle obtusely rounded; tympanum small, not exceeding three and a half millimeters in diameter; nostrils a little nearer the muzzle than the eye, and nearly as widely separated as the inner nares.

The young differs from the adult by having the colors more intense, the back is olivaceous brown, the spot on the temple black, and the under parts a more pronounced yellow. Length, 2 inches; head to axilla, 9 lines; hind legs, $2\frac{1}{2}$ inches; fore limb, $1\frac{1}{2}$ inches; transverse diameter of head, 9 lines; vertical diameter of head, 4 lines; transverse diameter of body, 9 lines.

Habitat, Nova Scotia, Maine, Massachusetts, New York, Pennsylvania and Virginia, to Ohio, Michigan and Wisconsin.

The Wood Frog is very abundant in the woods of Ohio, where it is found among damp fallen leaves, which it resembles so closely as to be overlooked. They appear in March or April, and go into winter quarters the last of October or forepart of November. They probably do not resort to ponds but hibernate in woods, and in spring lay their eggs,

in some cases, at least, in springs. They prefer thick oak or maple forests as a habitation, and in Maine their notes may be heard as early as April, but in our limits earlier. They are never found in the southern states. Their color is quite variable being darker in spring, but becoming paler after exposure for sometime to light. The young are eight lines in length immediately after the loss of their tail.

An interesting fact meets us by comparison of the specimens of *Rana temporaria* of the Old World with those of the New. That it is exceedingly variable is evident from the different varieties often mistaken for different species in this country and on the eastern continent. The most noteworthy fact, however, is that those of Japan and eastern Asia, in the size of the tympanum and coloration, are intermediate between those of Europe and our American varieties.

Some at least of the other Amphibia show the same relations, thus indicating, as pointed out by Prof. Marsh in regard to the extinct vertebrata, that there had probably once, if not oftener, been an interchange of faunas between the two continents through the region of Behring's Straits.

RANA CLAMITANS Daudin.

Green or Spring Frog.

Rana clamata, DAUDIN, DUMERIL and BIBRON, GUNTHER.

Rana clamata, et *flaviviridis*, HARLAN.

Rana clamitans, MERREM, HOLBROOK, ALLEN, VERRILL, COPE, JORDAN.

Rana fontinalis, LECONTE, STORER.

Rana clamitans, *fontinalis*, et *horiconensis*, DEKAY.

? *Rana nigrescens*, AGASSIZ.

Color above green to brown, without any large spots; legs and sides irregularly spotted or speckled with darker; beneath silvery white to yellow; gular region often irregularly spotted with darker; thighs granulated posteriorly; femur nearly as long as tibia; toes and fingers with small tubercles at most of the joints; tympanum of medium size or large, usually about eight or ten millimeters in diameter, but sometimes not over four, its color green, with a central nucleus of lighter green; eyes black; irides yellow; muzzle rounded somewhat; nostrils latero-vertical, half way between the eye and snout; inner nares medium, slightly more widely separated than the outer; vomerine teeth small, in two patches; dorso-lateral cutaneous fold well marked, reaching from the eye backwards. Length, 3 inches; head to axilla, $1\frac{3}{4}$ inches; hind leg, 4 inches; fore leg, $1\frac{1}{2}$ inches; transverse diameter of head, $1\frac{1}{2}$ inches; vertical diameter of head, $7\frac{1}{2}$ lines; transverse diameter of body, $1\frac{1}{2}$ inches.

Habitat, Nova Scotia, Maine, Massachusetts, New York, Pennsylvania, North Carolina, South Carolina, Georgia, Ohio, Michigan, Illinois, Arkansas.

The Green Frog is common along brooks and around ponds, sitting upon the banks, and plunging at the approach of danger. In wet weather

they leave the water and wander to some distance. They are among the earliest to awaken from their winter sleep, having been observed in March and April.

**RANA CATESBYANA* Shaw.

Bull Frog.

Rana catesbyana, SHAW, ALLEN, COPE, JORDAN.

Rana mugiens, MERREM, WAGLER, TSCHUDI, DUMERIL and BIBRON, GUNTHER.

Rana pipiens, HALLOWELL, HOLBROOK, KIRTLAND, STORER, DEKAY.

Rana pipiens, et scapularis, HARLAN.

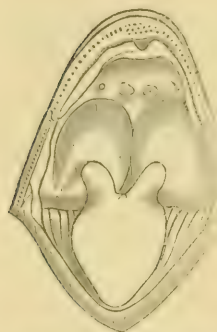


FIG. 3.—*Rana catesbyana*, head, $1\frac{1}{2}$ inches; transverse diameter of body, 3 inches.

mouth open, showing inner nares, teeth, and tongue. Habitat, Canada, Maine, Massachusetts, New York, Pennsylvania, Delaware, North Carolina, Louisiana, Arkansas, Texas, Kansas, Ohio, Michigan.

Color above greenish-brown, with darker irregular spots, these blotches more conspicuous upon the legs and sides; under parts yellowish white, often mottled with black or brown; legs above of the same color as the body, but the darker blotches often assume the form of transverse bars; femur shorter than the tibia; tubercles at some of the joints of the fingers and toes; tympanum in adult large, eight to twelve millimeters in diameter; nostrils half way between the eye and muzzle; pupils black; irides green; vomerine teeth in two nearly circular patches between the inner nares, the latter large and more widely separated than the outer. Length, $7\frac{1}{2}$ inches; head to axilla, $2\frac{1}{2}$ inches; hind leg $9\frac{1}{2}$ inches; fore leg, 4 inches; transverse diameter of head, $2\frac{1}{4}$ inches; vertical diameter of

The Bull Frog, called also by the boys Cow Frog, is very common, not only in the State, but also throughout its whole range. Its hoarse voice, low bass notes, supposed by some to be its love songs or call of the male to the female, have been compared to the roaring of a bull, hence the common name. They are aquatic animals, being found in ponds, ditches, and pools, occasionally coming to land, but only passing to any distance from the water in wet weather and at night.

Prof. Rogers states that "the frog is very susceptible to the enticements of motion." He has often caught them at the South by "agitating a hook and line baited with red tape," at which they would bite and entangle their teeth. Dr. Corse states that he has observed the spawn of frogs to develop on the fourth day, and has also known *Rana catesbyana* to pass a whole year in the tadpole State.

The Bull Frog is the one more commonly eaten, though any of them

* For anatomy of nervous system see Smithsonian Contributions, vol. 5.

may be used as articles of diet. Frequently only the hams are taken, but in some cases the animal is captured, killed, the viscera removed, and the body fried in eggs and bread crumbs. They are then said to be delicious, and it is reported that they are much used in this manner in certain places.

*ORDER URODELA. TAILED AMPHIBIANS.

Caudata, LEUCKART.

Body elongated, naked or without exoskeletal plates; tail compressed or cylindrical, persistent throughout life; feet usually two pairs, rarely only one; radius and ulna, as well as tibia and fibula, not united into a single piece; external opening of the cloaca a longitudinal slit.

Gills persistent throughout life.	. . . . .	PERENNIBRANCHIATA.
Gills caducous.	. . . . .	CADUCIBRANCHIATA.

SUB-ORDER PERENNIBRANCHIATA.

Amphipneusta, OPPEL.

Proteides, LEUCKART, HARLAN, MULLER, DUMERIL and BIBRON.

Phanerobranches, DUMERIL and BIBRON.

Pseudophydiens, DEBLAINVILLE.

Sirenideæ, TENNEY.

Ichtyoides, LATREILLE.

Branchiæ persistent; prefrontal, nasal and maxillary bones wanting; premaxillæ not ankylosed together; pterygoid absent or united with the palatines; vertebræ amphicoelous; carpus and tarsus cartilaginous, the latter sometimes absent; eyes without lids, in some cases surrounded by circular ring resembling a lid.

Pelvic arch and limbs wanting; extralimal.	. . . . .	TRACHYSTOMIDÆ.
Pelvic arch and limbs present.	. . . . .	PROTEIDÆ.

FAMILY PROTEIDÆ. THE MUD PUPPIES.

Skull elongated; parasphenoid edentulous; vomer with teeth along its anterior margin; premaxillæ and dentaries dentigerous; pterygoid present and ankylosed with the palatines; occipital condyles sessile; first two ceratohyals connate; branchæ, branchial apertures, and three pairs of arches persistent; eyelids wanting; pelvic and pectoral arches and limbs developed; anterior digits three or four, fourth finger, or in this case the third, the first being absent, with a single phalanx.

* Toes, two or three on each foot; trunk very much elongated; extralimal.

PROTEUS.

* Toes, four on each foot; trunk, short and thick. MENOBANCHUS.

*The classification and descriptions of this order are taken from the author's printed thesis on the Urodela and Cæcilia, to which any persons desiring information on extralimal species may refer.

* GENUS MENOBRANCHUS. Harlan.

Necturus, RAFINESQUE, WAGLER, COPE, GRAY.*Phanerobranchus*, FITZINGER.

Upper jaw with two curved rows of teeth, the posterior row nearly parallel with, and much longer than the anterior, situated upon the front edge of the vomer and lateral processes of the pterygoid; lower jaw with a single series of teeth, which lock between the two upper; tongue ovate, large, fleshy, free anteriorly and laterally; toes distinct, four in front and four behind; body short and thick; tail short, much compressed.

† MENOBRANCHUS LATERALIS Say.

Mud Puppy, Water Dog or Dog Fish.*Protis tetradactyle*, LACEPEDE.*Triton lateralis*, SAY.*Necturus maculosus*, *maculatus*, *luteus*, and *fuscus*, RAFINESQUE.*Necturus lateralis*, COPE, JORDON.*Menobranchus lateralis*, HARLAN, DEKAY.*Sirena maculosa*, RAFINESQUE.*Phanerobranchus cepedii*, FITZINGER.*Siredon hyemalis*, KNEELAND, and the following probably:*Necturus maculatus*, BAIRD.*Proteus maculatus*, BARNES.*Menobranchus maculatus*, HOLBROOK.*Menobranchus punctatus*, GIBBES.*Necturus punctatus*, COPE.

Body cylindrical, smooth, brownish, with darker spots and often a lateral line; head broad, depressed; eyes moderate; nostrils small; muzzle truncate; teeth large and conical; gular fold very strongly developed; gills red, three on each side. Length, 1½ feet.

Habitat, Santee River?, Ohio, Alleghany, and Hudson Rivers, the Great Lakes, Lake Champlain and Portage Lake. "Arkansas."

This species has not been heretofore reported from the Hudson River, but last spring while visiting the Natural History Society, at Poughkeepsie, N. Y., my friend, Dr. W. G. Stevenson, called my attention to

* Although this genus had been previously called in a vague manner by various names such as *Proteus*, *Salamandra*, *Triton*, and *Necturus*, Dr. Harlan first clearly elucidated its characters, and as his name has become well-known its retention is deemed proper and it is accordingly inserted here.

† Dr. Barton considered this to be a young *Menopoma alleghaniensis*, to which its skull bears such a relation as might be expected between larva and adult, but its geographical distribution is quite different and it is hardly possible that the adult, if existing in the region of the lakes could have been overlooked.

Cope, Journ. Acad. Nat. Sci. Phila., 1866, vol. vi, expresses the opinion that this is a larval *Spelerpes*, and changes to that as *Siredon* to *Amblystoma*. However, it has never yet been transformed.

one of these animals caught in the Hudson. He also informed me that one had previously been captured in that river. It had probably passed thence through the Erie canal or the one connecting the river with Lake Champlain.

Kneeland* states that this animal is nocturnal, feeds upon living worms, never dead ones unless very hungry, swallowed but could not digest minnows two and half inches long, has its gills nibbled off by small fish, and hence can survive by cutaneous and pulmonary respiration. Smith† confirms Kneeland's view of the pulmonary, as well as branchial respiration, in that he succeeded in inflating one of the pulmonary sacs. He also found a *Libellula* larva in the animal's stomach.

Their motions are very active when in the water, and are performed by the body and tail. They seem to be ill at ease when placed in the sun, and attempt to get out by retiring into a shady part. They have been known to live in water that froze a half inch every night for three months, but died in about four hours when removed from the liquid. When in water they may be observed crawling about over the bottom, rising to the surface at times and expelling a globule of air or effecting the same under water. They eat a number of worms a day, or go several months without food. At times they are found with parasitic worms near their gills. The flesh of this animal is said to be excellent eating.

SUB-ORDER CADUCIBRANCHIATA.

Branchiæ not present in the adult state; maxillary and nasal bones large; prefrontals usually present; premaxillæ separate or anchylosed, and always dentigerous.

*Branchial apertures upon the neck open. (DEROTREMATA) a.

*Branchial apertures closed in adult. b.

a. Anterior metacarpal bones three; extralimal. AMPHIUMIDÆ.

a. Anterior metacarpals four. MENOPOMIDÆ.

b. Anterior metacarpals four. SALAMANDRIDÆ.

FAMILY MENOPOMIDÆ. THE MENOPOMES.

Protonopsidæ, COPE.

Skull broad; parasphenoid edentulous; vomer with teeth along its anterior margin; premaxillæ and dentaries dentigerous; maxillæ and nasals large; pterygoid present and very broad; two separate premaxillary bones; prefrontals and parietals prolonged so as to embrace the frontals; fronto-temporal arch absent; occipital condyles sessile; basihyal cartilage present; gill holes open or closed; branchial arches may be reduced to two; upper and lower eyelids distinct; vertebrae amphicœlous; carpus and tarsus

* Proc. Bost. Soc. Nat. Hist., vol. vi, pp. 152, 371, and 429.

† Ann. Lyc. Nat. Hist., N. Y., vol. ii, p. 259.

cartilaginous: pelvic and pectoral limbs well developed; anterior digits four; fourth finger with three phalanges.

*Branchial apertures persistent. MENOPOMA.

*Branchial apertures closed in adult; extralimital. CRYPTOBANCHUS.

GENUS MENOPOMA. Harlan.

Palatine teeth in a parabolic curve between the inner nares, almost parallel to those of the maxillary; tongue transversely oval; head depressed; eyes small; parotids none; branchial apertures upon the side of the neck persistent; skin naked: limbs short and thick: toes four in front and five behind, the latter membranous; tail compressed shorter than the body.

*MENOPOMA ALLEGHANIENSIS Harlan.

Hell-Bender or Mud-Devil.

Protonopsis horrida, BARTON, BARNES, COPE.

Abranchus alleghaniensis, HARLAN.

Cryptobranchus salamandroides, LEUCKART.

Eurycea macronata, RAFINESQUE.

Molge gigantea, in part, MERREM.

† *Menopoma fusca*, HOLBROOK.

Salamandria horrida, et *gigantea*, or *maxima*, BARTON.

Salamandra alleghanensis, MICHAUX.

Menopoma alleghaniensis, COPE.

Body somewhat elongated, thick and strong; color slate with dark spots; toes five; fingers four; two outer toes with large membranous fringes; a broad expansion of the skin on the outer side of each limb; body with a cutaneous longitudinal fold on each side; tail long, very much compressed laterally, presenting a blade form appearance; head very broad and strongly depressed; muzzle rounded; nostrils small, well defined; inner nares large; mouth a parabolic curve; tongue large, fleshy, broad, filling the whole lower jaw, and free anteriorly. Length, 2 feet.

Habitat, Ohio and Alleghany Rivers, and North Carolina, "all tributaries of the Mississippi." Not of the Great Lakes.

The Hell bender is said to be very voracious, and feeds upon worms, cray fish, fishes, and aquatic reptiles. They also shed a membrane probably corresponding to the external layer of the skin. Grote observed them with this rolled up in the mouth as if in the act of swallowing it, and he believed that he perceived in another case the animal doing the swallowing.

A similar shedding of the epidermis having been observed in *Spelerpes porphyriticus*, *Dactylethra*, and *Cyclorhamphus*, it becomes probable that the remaining forms of this order also undergo a periodical moult-

*For Myology see Mivart's article, Proc. Zool. Soc., London, 1869.

† Cope makes *Menopoma fuscum* distinct with headwaters of the Tennessee as its habitat.

ing. The individuals observed by Grote all had an intermittent swaying motion in the aquaria during July and August, which he conjectured might be either connected with the animal's effort to cast the skin or a movement to attract the opposite sex. The *Menopoma* oviposits in August and September, probably for this purpose visiting the muddy banks of rivers. The eggs are at first about the size of a pea, enveloped in a glairy albuminous fluid. They are connected in strings, and increase after oviposition by imbibition of water. The Hell-bender at the time of pairing, changes its appearance, the tail becoming broader and the folds upon the sides varying.

FAMILY SALAMANDRIDÆ. THE SALAMANDERS.

Gradientia, OPPEL, GRAY.

Pseudo-sauriens, DEBLAINVILLE.

Atretoderes, DUMERIL and BIBRON.

Myctodera of some authors

Gill-slits perfectly closed in the adult state; skull broad; palatines present in the young, and arranged as in *Trachystoma* and *Proteida*, but change their relations with the growth of the animal; nasal bones usually large; dentaries and premaxillæ bearing teeth; limbs four, well developed; anterior toes four; fourth finger with three phalanges; eyelids two, an upper and a lower, very distinct.

Dumeril and Bibron contrasted the term *Atretoderes*, from *Atratos*, without a foramen, and *Deras* neck, with *Trematoderes*, which they applied to the remainder of the Urodela. The latter name etymologically considered seems to be a good one, but unnecessary, as is also its synonym, *Immutabilia* of Fitzinger.

*Vomero-palatine teeth in two longitudinal rows divergent behind, or sphenoidals present in two elongated groups, and thus divergent. *a.*

*Vomero-palatine teeth transversely arranged, or wanting, or convergent posteriorly.

AMBLYSTOMA.

a. Hind toes four on each foot. *b.*

a. Hind toes five. *c.*

b. Tongue attached in front by a membrane. HEMIDACTYLUM.

b. Tongue free all around, boletoid; extralimal. BATRACHOSEPS.

c. Sphenoidal teeth in two longitudinal groups of several rows each; vomero-palatines in a transverse series. *d.*

c. Sphenoidal teeth wanting; vomero-palatines in two longitudinal rows, never in a transverse series. NOTOPHTHALMUS.

d. Tongue attached in front by a membrane. *e.*

d. Tongue free all around, boletoid. SPELERPES.

c. Vomero-palatine teeth in a continuous transverse row; commissure much curved; extralimal. ANAIDES.

c. Vomero-palatine series more or less interrupted medially; commissure nearly straight. PLETHODON.

GENUS AMBLYSTOMA. Tschudi.

Plagiston, DUMERIL and BIBRON, includes *Xiphonura*, TSCHUDI, and *Heterotriton*, GRAY.

Palatine teeth in a transverse, often interrupted row, sometimes in the form of an arch or

crochet; toes, four in front, five behind, never palmate; tongue fleshy, round or long, centrally attached, with lateral and anterior margins free; quadrato-jugal bone wanting; skin smooth, slimy, perforated with mucous pores, especially above the orbits and in the parotid region; costal furrows strongly marked; tail short, round to oval at the base, but compressed towards the extremity; vertebrae amphicelous; parasphenoid not dentigerous; orbitosphenoid and pro-otic separated by membranes; posterior margins of palatines bearing the teeth; carpus, tarsus, and basi-hyal ossified in adults.

Spots large, very different from the usual color. *a.*

Spots none, minute, or nearly uniform with the ground color. *l.*

a. Plantar tubercles two. *h.*

a. Plantar tubercles indistinct or none. *b.*

b. Costal grooves 14; vomerine series of teeth two. *f.*

b. Costal grooves 12. *e.*

b. Costal grooves 11; vomerine series of teeth 3. *c.*

b. Costal grooves 10; vomerine series of teeth 3; extralimal, Georgia, Louisiana, and Illinois. *A. TALPOIDEUM.*

c. Color black; spots or bands large; median series of teeth concave behind or straight. *d.*

c. Color plumbeous; spots small; median series of teeth convex behind; extralimal. *A. CONSPERSUM.*

d. Back with transverse bands of gray. *A. OPACUM.*

d. Back without transverse bands of gray. *A. PUNCTATUM.*

e. Vomerine series of teeth 3; canthus rostralis distinct; back with a gray line. *A. MACRODACTYLUM.*

e. Vomerine series of teeth two; canthus rostralis none; no gray dorsal line; extralimal. *A. TENEBROSUM.*

f. Canthus rostralis wanting. *g.*

f. Canthus rostralis distinctly marked; extralimal. *A. TEXANUM.*

g. Back and tail with gray rings or bands; extralimal, South Carolina. *A. CINGULATUM.*

g. Back plumbeous; sides spotted. *A. MICROSTOMUM.*

h. Costal grooves twelve, *i.*

h. Costal grooves eleven; vomerine series of teeth three; extralimal, New Jersey. *A. BICOLOR.*

i. Tail shorter than body; canthus rostralis wanting. *j.*

i. Tail longer than body; canthus rostralis distinct. *A. XIPHIAS.*

j. Vomerine teeth in a nearly continuous line. *k.*

j. Vomerine teeth in four distinct patches; extralimal; New Mexico. *A. TRISRUPTUM.*

k. Nares inequidistant; yellow spots usually small. *A. TIGRINUM.*

k. Nares equidistant; yellow spots large; extralimal, Dakota, Montana, California, Nebraska, New Mexico, and Mexico. *A. MAVORTIUM.*

l. Plantar tubercles indistinct or none. *m.*

l. Plantar tubercles two, distinct; extralimal, Iowa. *A. OBSCURUM.*

m. Costal grooves twelve or more. *n.*

m. Costal grooves eleven; extralimal, Vancouver's Island and Washington Territory. *A. PAROTICUM.*

n. Vomerine series of teeth three, extending to exterior of nares.

A. JEFFERSONIANUM.

- n. Vomerine series of teeth two, extending only to interior of nares; extralimital, Northern Rocky Mountains. . . . A. ATERRIMUM.

AMBLYSTOMA PUNCTATUM Linnæus.

Large Spotted or Violet Colored Salamander.

Amblystoma subviolaceum, TSCHUDI.

Salamandra subviolacea, DEKAY, HOLBROOK, HARLAN, SCHLEGEL, KIRTLAND.

Salamandra punctata, LACEPEDE, WAGLER.

Salamandra venenosa, BARTON, DAUDIN.

Lacerta subviolacea, BARTON.

Lacerta punctata, LINNÆUS.

Lacerta maculata, SHAW.

Amblystoma punctatum, BAIRD, COPE, JORDON.

Color black, at least above, sometimes slightly purplish, changing to brown in alcohol; two sets of bright yellow spots arranged somewhat in rows on each side of the back; legs also spotted, spots unequal and change to white in alcohol; tail oval, compressed at the end; body cylindrical; head large, depressed; muzzle rounded, skin smooth, perforated with pores; two patches of these on each side of the head, one reaching from nostril backwards, above and somewhat around the eye, the other in the parotid region; cervical fold strong; another fold present behind the eye, the two connected by a ridge; costal furrows eleven, strongly marked, sometimes with others less marked; furrows behind the leg in the anal region four, and others less prominent upon the tail; back with a longitudinal groove; tail indistinctly furrowed lengthwise upon the side; eyes prominent; nostrils small, distinct. Total length, 6 inches; length at loss of branchiæ, 1.5-6 inches; body $2\frac{1}{2}$ inches; head to gular fold, $\frac{2}{3}$ inch; diameter of head, $\frac{5}{8}$ inch.

Habitat, Nova Scotia, Canada, Maine, Massachusetts, New York, Pennsylvania, Virginia, South Carolina, Louisiana, Arkansas, Tennessee, Ohio, Michigan, Wisconsin, and Illinois.

The Violet Colored Salamander is found under rocks and decaying matter in damp forests and sometimes in cellars. It appears to be nocturnal, and like the rest of these animals is perfectly harmless.

AMBLYSTOMA OPACUM Gravenhorst.

The Opaque or Blotched Salamander.

Salamandra opaca, GRAVENHORST.

Salamandra gravenhorstii, LEUCKART.

Salamandra fasciata, GREEN, HARLAN, HOLBROOK, STORER, WAGLER, DEKAY.

Amblystoma opaca, BAIRD, COPE, JORDAN.

Color above light clay or ash, with transverse, dark brown or bluish bands, sometimes in blotches, and extending from head to tail; below, dark slate; head with a triangular spot; in alcohol the animal is a grayish ash, with transverse bands of dark brown or brownish black; tail oval, with indistinct lateral furrows; body nearly cylindrical, thickest in the middle; head large, depressed; muzzle round; mucous pores of the skin numerous, about equally distributed, hence no special patches above the eye and in the

parotid region; cervical fold, fold behind the eye and connecting groove, costal furrows, and furrows in the anal and caudal region, as in *A. punctatum*; dorsal longitudinal groove less marked than in that species, but still distinct; eyes small yet prominent; nostrils minute. Total length at loss of branchiæ, 2 1-6 inch; length, 3½ inches; tail, 1½ inches; body, 2 inches; head to cervical fold, ½ inch; diameter of body, ½ inch; diameter of head, 15-16 inch.

Habitat, Massachusetts, New York, Pennsylvania and Florida, to Texas, Wisconsin, Michigan and Ohio.

Cope says, "The principal difference in form and structure between this species and *A. punctatum* is seen in the absence of any dorsal furrow, or a less prominence of that on the side of the tail. The limbs are more feeble, the head narrower, etc." In the eight specimens before me, however, all of which came from Southern Illinois, the dorsal groove is very distinct. In a specimen from Ann Arbor it is barely visible. In these the most prominent mark of the species is its color, which differs very strikingly from that of *A. punctatum*.

Mann* states that this animal lays its eggs in the beds of small ponds, and in some cases the number of these amounts to one hundred and eight. He found them in this situation in summer, and also in November, and always with the male and female curled up over the eggs as if in the process of incubation.

AMBLYSTOMA TIGRINUM Green.

The Tiger Salamander.

Salamandra tigrina, GREEN, HARLAN.

Salamandra ingens, GREEN.

Salamandra lurida, SAGER.

Triton tigrinus, HOLBROOK, DEKAY.

Amblystoma episcopus, HALLOWELL, BAIRD.

Amblystoma luridum, BAIRD, HALLOWELL.

Amblystoma tigrinum, BAIRD, COPE, JORDAN.

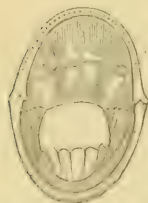


FIG. 4.—*Amblystoma tigrinum*, mouth open.

Color in alcohol varying from brown to lurid above, plumbeous and yellowish white below, the yellowish white in blotches, between the brown and plumbeous, sometimes connected longitudinally; spots varying from reddish brown to white, yellow in fresh specimens, extending from the head to the tail, and scattered irregularly; tail, oval; body cylindrical in some, in others thickest in the middle and tapering both ways; head depressed; muzzle round; skin smooth, with numerous mucous pores; gular fold and fold behind the eye, with connecting parotid ridge; costal furrows eleven strongly marked. and others becoming indistinct; furrows behind the legs gradually ceasing, so that the tip of the tail is smooth; back with a longitudinal groove; tail without any indications of lateral furrows; eyes prominent; nostrils small, distinct; plantar tuber-

* Smithsonian Reports, 1854, page 294.

cles two, well developed. Length at loss of branchiae $3\frac{1}{2}$ inches. Adult, length, 7 inches; tail $\frac{1}{2}$; body, 4 inches; head to cervical fold, 1 inch; diameter of body, 1 inch; diameter of head, $\frac{1}{3}$ inch.

Habitat, Michigan, Wisconsin, Minnesota, Nebraska, Missouri, Illinois, Ohio, Louisiana, New Jersey, and New York.

Hoy* states that this animal moves very slowly upon land, but is very active in water. Insults offered to its mouth or eyes are resented by strokes of the tail. They are nocturnal in habits, and usually remain in concealment during the day. They have been observed in great numbers in the Cathole, at Ann Arbor, Michigan, swimming vigorously on March 10th, and their eggs were found a few days later, after which they disappeared, passing into the woods and excavating burrows, in which they awaited their prey, being concealed, all but their heads. In the fall they wander about in search of a suitable place in which to hibernate, and at this time often stray into cellars during a wet night.

AMBLYSTOMA JEFFERSONIANUM Green.

The Granulated Salamander.

Salamandra granulata, DEKAY.

Triton niger, DEKAY.

Xiphonura jeffersoniana, TSCHUDI, GRAY.

Salamandra jeffersoniana, GREEN, HOLBROOK, HARLAN, SCHLEGEL.

Amblystoma fuscum, † HOLBROOK.

Amblystoma laterale, † HALLOWELL.

Amblystoma jeffersonianum, BAIRD, COPE, JORDAN.

Amblystoma platineum, † COPE.

Color black to greenish in alcohol, above, greenish slate, without blotches or spots, below, of a grayish green tinge; cervical fold white; tail roundish oval; body cylindrical, much longer and slimmer than *A. punctatum*; head elongate, apparently not separable from the body; muzzle round; mucous pores of the skin distributed over the body generally, and not collected in special groups; cervical fold indistinct, but its place marked by a white band; fold and connecting ridge behind scarcely discernible; costal furrows thirteen, less marked than in *A. punctatum*, but nevertheless distinct, or at least their place represented by a whiter color; furrows behind the leg also less prominent, and extending almost to the tip of the tail; dorsal longitudinal groove nearly or quite indistinct; lateral caudal furrows wanting, but a sub-caudal extends from anus to tip; eyes small but prominent; nostrils minute; adult, length at loss of branchiae, 1 3-5 inches; length, $3\frac{1}{2}$ inches; tail, 1 9-16 inches; body, 2 1-16 inches; head to cervical fold 7-16 inch; diameter of body, $\frac{1}{8}$ inch; diameter of head, 2-16 inch.

Habitat, Vermont, New York, Pennsylvania, Southern Illinois, Wisconsin, Missouri, Ohio, Michigan to north shore of Lake Superior, and the country included.

* Smithsonian Report, 1854, page 295.

† Cope makes three sub-species, viz., *laterale*, *fuscum*, and *platineum*.

AMBLYSTOMA MICROSTOMUM Cope.

Small-Mouthed Salamander.

Triton porphyriticus, (?) HOLBROOK.

Color in alcohol brownish black, paler beneath; plumbeous spots of iodinite outline scattered thickly and irregularly over the sides, sometimes wanting, at others licheniform; tail round or nearly so at the base, but becoming ensiform towards the end; body slender; length about thirteen times its greatest diameter; head narrower than and not separable from the body; projection of upper jaw not as great as that of the lower; dorsal furrow present, but not deeply indented; mucous pores of the head not different from those of the body; lingual longitudinal furrow present; length at loss of branchiæ, 2.2-5 inches; length, 4 inches; tail, 1½ inches; body, 2¼ inches; head to cervical fold, .45 inch; diameter of head, .31 inch.

Habitat, Illinois, Missouri, Arkansas, and Ohio to Louisiana.

This species very closely resembles *Plethodon glutinosus*, but is distinguished from it by the arrangement of the teeth in a transverse uninterrupted row, arched in front instead of being separated by a wide interval, and also by the tail being very much compressed laterally; while in *P. glutinosus* it is cylindrical, or only slightly compressed. *Triton porphyriticus* of DeKay is probably *Plethodon glutinosus*.

AMBLYSTOMA XIPHIAS Cope.

Long-Tailed Salamander.

Color yellowish olive, brighter yellow beneath; sides and back with brown anastomosing or reticulating bands; head small; cheeks swollen; eyes rather small, but distinct; mandible projecting; outer nares nearer together than the inner; tongue large; vomerine teeth Y-form, at an obtuse angle, interrupted along the median line

GENUS HEMIDACTYLIUM. Tschudi.

Desmodactylus, DUMERIL and BIBRON.

Vomerine teeth in two rows, one on each side behind the inner nares, sphenoidals also in two groups, separated from the former and each other; tongue oval, adherent in front; parietal bones osseous; premaxillaries two; fontanelle wanting; toes rudimentary, palmate at base, four in front and four behind.

HEMIDACTYLIUM SCUTATUM Schlegel.

Four-toed Salamander.

Salamandra fava, GRAY, Jour. A. N. Science, Phil., 1813, page 357, not of Rafinesque.

Salamandra scutata, SCHLEGEL.

Salamandra melanostica, GIBBES.

Desmodactylus melanosticus, DUMERIL and BIBRON.

Hemidactylium scutatum, TSCHUDI, BAIRD, COPE, JORDAN.

and limbs of the V curve; tail, oval, crestless, grooveless, longer than the body, compressed from the base and not elevated; digits triangular, depressed; length, $11\frac{1}{4}$ inches; tail, 6 inches; head to cervical fold, 1 inch; breadth of head, .88 inch.

Habitat, Columbus, Ohio.

GENUS PLETHODON. Tschudi.

Phatnomatorhina, BIBRON.

Plethodon and *Desmognathus*, BAIRD, COPE.

Vomerine teeth in two patches, one behind each of the inner nares, rarely wanting; sphenoidal teeth numerous in two almost quadrilateral groups; tongue large, round, or oval, entire or slightly notched behind, adherent in front, and centrally, laterally and posteriorly free; skin, smooth; body, cylindrical; tail, round, tapering to the tip; toes, four in front and five behind; premaxillaries, two.

With the exception of *Plethodon persimilis*, the exact position of which is doubtful, the following table will serve for the determination of the species:

* Sphenoidal teeth in two medially contiguous groups; vomerine patches separated by a distinct interval. a.

* Sphenoidal teeth in two not contiguous groups; vomerines often approximated. d.

a. Color cinereous; dorsal band red, rarely wanting. b.

a. Color black; dorsal band always wanting. c.

d. Costal furrows thirteen or less; muzzle truncate; vomerine series of teeth medially approximated. e.

d. Costal furrows fourteen or more; muzzle round; vomerines few or none. f.

b. Costal furrows sixteen or more. P. ERYTHRONOTUS.

b. Costal furrows fourteen, extralimital; California to Vancouver's Island.

P. INTERMEDIUS.

c. Costal furrows fourteen, with irregular gray blotches. P. GLUTINOSUS.

c. Costal furrows twelve; color uniform black; extralimital, Massachusetts, New York, Pennsylvania, Virginia, South Carolina, Georgia, and Louisiana. P. NIGER.

e. Plantar tubercles two, in front; spots minute; extralimital; Oregon to California. P. OREGONENSIS.

e. Plantar tubercles none; spots large, orange; extralimital; Lower California.

P. CROCEATER.

f. Dorsal band wanting; dots red or none; toes long; body marbled below.

P. FUSCUS.

Color above, brown, muzzle yellowish, limbs and tail orange brown; upper surface with black spots on each side scattered irregularly; beneath white, with pitchy black spots, especially numerous in the gular region; head large; muzzle obtuse; eyes not very prominent; iris yellow; pupil black; gular fold well developed; costal furrows well marked; skin of the back similarly cut, making it resemble scute; body cylindrical, short; limbs slender; tail round at base, compressed distally, equal to and sometimes twice the length of the body. Length 2-5 inches.

Habitat, Rhode Island to South Carolina, Illinois, and the Gulf of Mexico.

Not yet recorded from Ohio, but inserted here on account of its extralimital range. It has been found in April under old logs and rails in open woods, at some distance from the water, and was very quick and lively in its movements.

- f. Dorsal band yellowish; dots brown; toes short; body dirty white below; extralimital; New York, Pennsylvania to Georgia. . . P. OCHROPHÆUS.

* PLETHODON ERYTHRONOTUS Green.

The Red-Backed Salamander.

Salamandra erythronota, GREEN, STORER, DEKAY, HOLBROOK, HARLAN.

Salamandra agilis, SAGER.

Plethodon cinereus, TSCHUDI.

Amblystoma erythronotum, GRAY.

Sauropsis, FITZINGER.

Spelerpes erythronotus, KENNICOTT.

Plethodon cinereus, COPE.



Color upon the sides cinereous; dorsal stripe extending from the occiput to the extremity of the tail of deep or light red; head brown above; lower jaw and gular region whitish, ventral part of the body light, but not as much so as the throat and chin; sides in alcohol sometimes reddish brown, and dorsal stripe cream colored; eyes large, black; head somewhat depressed, scarcely separable from the body; canthus rostralis none; costal grooves sixteen to nineteen; caudal furrows about twenty; cervical fold indistinct, its place represented by a white line; nostrils laterally situated; length, $3\frac{1}{2}$ inches; tail, $1\frac{1}{2}$ inches; head to cervical fold, 9-16 inch; width of head, 7-32 inch.

Habitat, Nova Scotia, Maine, Massachusetts, New York, Pennsylvania, South Carolina, Kentucky, Ohio, and Michigan, as far as the northern shore of Lake Superior.

FIG. 5.—*Plethodon erythronotus*, mouth open.

Very common.

Haldeman † states that, while Herpetologists have supposed that *P. erythronotus* and *cinereus* are different sexes of the same species, from their having been often found associated together, yet he, as a result of careful examination, came to the conclusion they were not. Four *cinereus* opened by him contained gravid ovaries, and hence were females; on the other hand, two *erythronotus* contained only seminal matter and spermatozoa, imperfectly developed. Two others were found, however, with gravid ovaries, hence we have of the *erythronotus* both male and female. Prof. Green, however, concluded, after careful revision, that the *cinereus* was probably only an aged individual, in which the dorsal stripe had become obsolete.

The Red-backed Salamander is the first of this group seen in spring, having been observed in the middle of April. I found them near Vassar College, in New York State, on April 6, 1878. It oc-

* Proc. Acad. Nat. Sci. Phil. 1874, page 315.

† Cope recognizes three sub-species, *erythronotus*, *cinereus*, and *dorsalis*.

curs in moist, woody places, hiding under stones and old logs, and when these are upturned it, if alone, quickly disappears in the decaying wood, moss, leaves, or earth; but, if accompanied by its young, neither it nor the little ones attempt to escape until touched. It climbs glass by adhering with its abdomen, is frequently curled up on herbs, and, if disturbed, springs away by a sudden uncoiling. They are very agile in their motions, walk rapidly, run by sudden and irregular jerks, and have been kept alive an entire year by allowing them dead leaves constantly moistened. Their food appears to be small snails. When the young are found, as a rule, they are accompanied, and often apparently being fed, by their parents, but are occasionally alone. Their little ones, as well as their eggs, occur under the moss and bark of decayed trees. The latter are found in bunches of from six to eleven each, and individually are about three-twentieths of an inch in diameter, and have been found in June at Ann Arbor, Michigan, Fitchburg, Massachusetts, and in August in the White Mountains.

The young are supplied with branchiae, but lose them early, that is, in about three or four days after hatching. The little ones usually have the same markings as the adult, but are often bright red, spotted with black. The younger larvæ are nearly white; the older olive, with dark spots. As age advances, the color deepens, becoming a brown, and very old specimens often have a purplish tint.

PLETHODON GLUTINOSUS Green.

The Gray Spotted or Viscid Salamander.

Salamandra glutinosa, GREEN, SCHLEGEL, KIRTLAND, HARLAN, HOLBROOK, STORER, DEKAY.

Salamandra variolata, GILLIAMS.

Salamandra cylindracea, HARLAN, KIRTLAND.

Plethodon variolosum, TSCHUDI, DUMERIL and BIBRON.

Cylindrosoma glutinosum, DUMERIL and BIBRON.

Triton porphyriticus? DEKAY.

Plethodon granulatum, GRAY.

Salamandra elongata, VALENCIENNES.

Plethodon glutinosus, TSCHUDI, BAIRD, COPE, JORDAN.

Color above glossy black, with numerous minute gray spots, larger upon the sides, in some almost confluent, in others licheniform patches; color below plumbeous, with small spots of gray in the gular region; legs also spotted; cervical fold and a narrow strip on each side of anus of a yellowish tinge; costal furrows fourteen; nares equidistant; vomerine series of teeth extending to the exterior of inner nares; canthus rostralis none; nostrils small, laterally situated; head and body scarcely or not at all separable; cervical or gular fold distinct; body with a dorsal longitudinal furrow; tail

long, round, tapering; legs moderately long, slender, and not very strong; head, depressed; eyes not as prominent as in *P. erythronotus*. Length, $4\frac{1}{2}$ inches; tail, 2 inches; head to cervical fold, $\frac{1}{2}$ inch; breadth of head, $\frac{3}{8}$ inch.

Habitat, Massachusetts, New York, Pennsylvania, Georgia, Florida, Mississippi, Louisiana, Illinois, Ohio, and the country included, Straits of Belle Isle.

This animal conceals itself under rocks and logs in moist places, but has been found upon dry, elevated ground. The color seems to vary much with age, the young being much more thickly spotted than the adult. In the specimens before me, this variation is not influenced by locality. They hibernate beneath wet logs, and go into the water to breed in April, in Georgia, and probably a little later in our limits.

PLETHODON FUSCUS Rafinesque.

Dusky Salamander.

Salamandra picta, HARLAN, STORER, DEKAY.

Salamandra intermixta, GREEN, KIRTLAND.

Salamandra quadramaculata, HOLBROOK.

Triturus fuscus, RAFINESQUE.

Desmognathus fusca, BAIRD, VERRILL, COPE.

Salamandra auriculata, HALLOWELL, GRAY, BAIRD.

Cylindrosoma auriculatum, DUMERIL and BIBRON.

Salamandra haldemani, ? HOLBROOK.

Spelerpes haldemani, ? HALLOWELL.

Plethodon fuscus, HALLOWELL.



Color brown marbled with pink; vertebral region not so dark; laterally and ventrally still lighter, sometimes yellowish or very light orange, but generally brown and white marbled; chin and gular region almost white; head very much depressed; muzzle round, not truncate; parasphenoidal teeth not complete. *Aglossa*; vomerine row in 2 rows on each side, often wanting; eyes prominent; dorsal longitudinal furrow present; cervical fold, postorbital and parotid grooves well marked; costal furrows thirteen to fifteen, usually fourteen, limbs small; toes long and slender; vertebrae opisthocœlous; tail compressed, carinate above, sometimes terminating in a fin, but usually pointed. Length, $3\frac{1}{2}$ inches; tail, $1\frac{1}{2}$ inches; head to cervical fold, $\frac{1}{2}$ inch; breadth of head, 5-16 inch.

Habitat, Maine, Massachusetts, New York, Pennsylvania, New Jersey, Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi, Tennessee, Indiana, and Ohio.

Var. *auriculatus* differs from this by being black or nearly so above, with a reddish spot behind and below the eye, and minutely punctate with red upon the sides; extralimital.

Habitat, South Carolina to Louisiana.

Flies to shallow brooks, and emits its eggs in a string connected by albuminous matter, which is afterwards wound around the body by one of the pair.

GENUS SPELERPES. Rafinesque.

Ventrine teeth in a transverse row, behind the inner nores, interrupted medially; sphenoidals in two elongated groups; separated from each other, usually narrower in front and diverging behind; tongue bifid; head short, depressed; body cylindrical, slender; digits five, four in front and five behind; tail long, tapering and distally compressed.

Body with distinct spots or bands. a.

Body spotless, or with minute dots; extralimital, Arkansas. . S. MULTIPLICATUS.

a. Costal furrows 15-17. b.

a. Costal furrows 14 or less. c.

b. Color in the main red. S. RUBER.

b. Color cinereous and white, with black; extralimital, Georgia.

S. MARGINATUS.

c. Color above yellow. f.

c. Color above cinereous, lines black. S. BILINEATUS.

c. Color above brown. S. PORPHYRITICUS.

f. With dark spots; no vertebral line. S. LONGICAUDUS.

f. With black vertebral line; extralimital, North Carolina, South Carolina, and Georgia, to Alabama. S. GUTTOLINEATUS.

SPELERPES BILINEATUS Green.

Striped-back Salamander.

Salamandra bilineatus, GREEN, HOLBROOK, HARLAN, CUVIER, DEKAY.

Salamandra flavissima, HARLAN, HOLBROOK.

Salamandra cirrigera, GREEN, HARLAN.

Spelerpes cirrigera, BAIRD, GRAY, HALLOWELL.

Bolitoglossa bilineata, DUMERIL and BIBRON.

Spelerpes bilineatus, BAIRD, ALLEN, COPE, JORDAN.



Fig. 8.—*Spelerpes bilineatus*, mouth open.

Color above cinereous, with two or three longitudinal black lines; vertebral line narrow, but broader in front, sometimes nearly or quite effaced; below yellow or yellowish white; color very much obscured by alcohol; head oval; eyes ovate; irides yellow; postorbital and parotid folds distinct, gular only marked by a cicatrix; costal grooves fourteen, in most specimens indistinct; limbs slender; digits long, excepting the first and last; tail nearly or quite as long as the body and sometimes longer. Length, 2 $\frac{3}{4}$ inches; tail, 1 $\frac{1}{2}$ inches; head to gular fold, $\frac{2}{3}$ inch; breadth of head, 3-16 inch.

Habitat, Maine, Massachusetts, New York, Pennsylvania, Georgia, Florida, Louisiana, Ohio, and Wisconsin.

Common. Lives under stones and decaying matter in woods and moist places, especially along the banks of brooks and in shallow water, and is very active.

Var. *cirrigera* seems to differ from this mainly in the possession of two barbels between the nostrils and lip in the male; they are not present in the female. Green says, "when these animals were alive the

cirrho or nasal appendages were about one-fourth of an inch long. From the situation where they were found, and from their general appearance, they must be placed among the Land Salamanders; but their fleshy cirrho seem conclusively to prove that their principal resort must be in the water."

SPELERPES LONGICAUDUS Green.

Cave or Long-tailed Salamander.

Salamandra longicauda, GREEN, HOLBROOK, KIRTLAND, DEKAY, HARLAN.

Spelerpes lucifuga, RAFINESQUE.

Cylindrosoma longicaudatum, TSCHUDI, DUMERIL and BIBRON.

Sauvoscercus longicaudus, FITZINGER.

Spelerpes longicaudus, BAIRD, COPE, JORDAN.

Color yellow; body, head, chin, and gular region cream-colored, belly yellowish white; spots dark colored, numerous, and irregular in form, scattered thickly over the upper and lateral surface; below immaculate; head nearly oval, more depressed than in the preceding species; vomerine teeth and sphenoidal groups not contiguous; eyes elongated, not very prominent; nostrils lateral and minute; postorbital fold invisible, parotid well marked, but the place of the gular represented by a scar; limbs slender; digits moderate, widely separated; tail very long, nearly equalling and sometimes exceeding twice the length of the body; back without a longitudinal groove, but with the spots here and upon the sides arranged somewhat in rows. Length, 5 inches; tail 3 1-5 inches; head to gular fold, $\frac{5}{8}$ inch; breadth of head, $\frac{1}{2}$ inch.

Habitat, Maine, New York, Pennsylvania, Florida, Louisiana, Kentucky, Ohio, and Wisconsin.

From the State I have seen but one specimen, which was captured near Lancaster. It frequents running water in deep caverns, and thus resembles the *Proteus* of Carniola. Its subterranean habits prepare us to expect what we actually find it to be, one of our most beautiful species of Salamander.

SPELERPES RUBER Daudin.

The Red Salamander.

Salamandra rubra, DAUDIN, HOLBROOK, DEKAY.

Salamandra maculata, GREEN, STORER, HARLAN.

Salamandra rubriventris, GREEN, KIRTLAND.

Salamandra subfusca, GREEN.

Salamandra fusca, HARLAN.

Pseudotriton subfuscus, TSCHUDI.

Mycetoglossa ruber, BIBRON.

Mycetoglossus subfuscus, BONAPARTE.

Siren operculata, PALISSOT BEAUVOIS.

Proteus neo-cæsariensis, GREEN.

Pseudotriton ruber, BAIRD.

Pseudotriton sticticeps,* BAIRD.

Pseudotriton montanus, BAIRD.

Pseudotriton flavissimus, HALLOWELL.

Color above red, with numerous nearly circular small black spots; beneath less vivid and immaculate, except in the gular region: in alcohol the color is dark yellowish or light brownish, and the spots brown: head in perpendicular longitudinal sections nearly a perfect triangle, in width equal to the body and not separable from it; muzzle round; *sphenoidal and vomerine teeth contiguous* at the anterior margin of the former, the latter continuing outwardly to posterior of inner nares; eyes prominent; nostril minute; postorbital and parotid grooves indistinct; gular fold strongly marked; costal furrows fourteen to sixteen; tail and anal region with numerous circular folds indistinct above and disappearing distally; a longitudinal groove runs from the anus towards the extremity of the tail; skin upon the back forming a longitudinal ridge from the nape backwards; limbs moderate, hind ones much the strongest; inner toes longest; tail round at the base, but compressed distally. Length, 5 inches; tail, $1\frac{1}{2}$ inches; head to gular fold, $\frac{5}{8}$ inch; breadth of head, $\frac{1}{2}$ inch.

Habitat, Maine, Massachusetts, New York, Pennsylvania, Georgia, Florida, Texas, Minnesota, and Ohio.

The Red Salamander is found under stones or in shallow water and marshes very early in the spring. On April 6, 1878, I found two near Vassar College in New York State, under a stone. When discovered they seemed to be alarmed and endeavored to get away, but when in marshes showed no disposition to stir. They are apparently nocturnal animals, remaining in concealment during the day and at night sallying forth in search of prey. Their food is mainly small worms, though Hallowell found in the stomach of one a coleopterous insect, and the tail and posterior limbs of a Salamander, probably *Plethodon niger*, and they are themselves devoured by the American Bittern, and doubtless many other animals in like manner prey upon them. In confinement they rarely leave the water in the daytime, but usually do so at night.

The little ones may readily be confounded with the young of *Plethodon erythronotus* to which in color it bears a marked resemblance, but the attachment of the tongue is quite different.

SPELERPES PORPHYRITICUS Green.

Salmon-colored or Purple Salamander.

Salamandra porphyritica, GREEN, KIRTLAND, HOLBROOK.

Salamandra salmonca, STORER, HOLBROOK, DEKAY.

Pseudotriton salmoneus, BAIRD, HALLOWELL, ALLEN.

*Cope makes *sticticeps* a sub-species with habitat South Carolina, and *montanus* also a sub-species with a range from Pennsylvania to South Carolina in Alleghany Mountains.

Spelerpes salmoncus, GRAY, COPE.

Gyrinophilus porphyriticus, COPE.

Amblystoma salmoncum, DUMERIL and BIBRON.

Color yellowish-brown above; sides salmon color, with a tinge of yellow; upper surface irregularly marked with gray, below white; tail yellowish, head large, flattened; muzzle truncate; eyes prominent, and distant from each other; inner nares large; nostrils small; gular fold strongly marked; canthus rostralis prominent; dorsal longitudinal groove present; costal furrows usually fourteen; limbs moderate; digits entirely distinct; tail compressed and carinate. Length, 5.7 inches; tail, 2.3 inches.

Habitat, Maine, Vermont, Massachusetts, New York, Pennsylvania, Alabama, and Ohio.

The Salmon-colored Salamander is found on moist land, under logs in damp woods, and in still water. It attempts self-defense, snaps savagely, and throws its body into contortions when disturbed. In confinement it appeared healthy for a year, and lived upon flies.

Prof. Baird* calls attention to this animal being much more easily discovered in a larval than in the mature condition near Carlisle, Pennsylvania, stating that he had caught hundreds of larvæ before finding a single adult. It is included in this list as coming from Ohio on authority.

GENUS NOTOPHTHALMUS. Rafinesque.

Teeth in two longitudinal series, closely approximated in front, divergent behind; tongue attached anteriorly and posteriorly, and with only a small portion of its lateral margins free: premaxillary arch long and strong, formed by the union of the tympanic and frontal bones; palatine processes cuneiform; spinous process of vertebra quadrangular; ribs rudimentary; tail small, compressed from the base; toes four in front and five behind, the first and fifth rudimentary.

NOTOPHTHALMUS VIRIDESCENS Rafinesque.

Newt, Evet, Eft or Crimson Spotted Triton.

Triturus viridescens,† RAFINESQUE.

Diemyctylus viridescens, RAFINESQUE, HALLOWELL, VERRILL, COPE, ALLEN.

Diemyctylus miniatus,† RAFINESQUE, HALLOWELL, VERRILL, COPE, ALLEN.

Salamandra stellio, SAY.

Salamandra symmetrica, HARLAN, HOLBROOK, KIRTLAND, DEKAY, STORER.

Salamandra punctatissima, WOOD.

Salamandra dorsalis, HARLAN, HOLBROOK, KIRTLAND, STORER.

Salamandra millepunctata, STORER.

Salamandra coccinea, ? DEKAY.

Notophthalmus miniatus, STORER.

*Journ. Acad. Nat. Sci. Phil., 1850.

†Cope makes two sub-species, *viridescens* and *miniatus*.

Triton millepunctatus, DEKAY.

Triton dorsalis, HALL.

Triton symmetricus, punctatissimus, et dorsalis, DUMERIL and BIBRON.



Fig. 7.—*Notophthalmus viridescens*, mouth open.

Color varying from olive to scarlet above, from orange to red beneath, the two colors abruptly separated; sides with five or more ocellate spots, often arranged in a line and sometimes with others similar but smaller spots lower down; entire under surface punctate with black dots, which sometimes cover the back and tail as well; head oval; muzzle rounded at the apex; commissure of the mouth not extending behind the posterior canthus of the eye; gular and postorbital folds wanting; costal grooves about fourteen, indistinct; back usually with a dorsal crest; tail strongly emarginated above and below. Length, $3\frac{1}{4}$ inches; tail, $1\frac{1}{2}$ inches; head to axilla, $\frac{1}{2}$ inch; breadth of head, $\frac{1}{2}$ inches.

Habitat, Canada, Maine, Vermont, Massachusetts, Connecticut, New York, Pennsylvania, Georgia, Florida, Illinois, Ohio and Michigan.

The Crimson Triton is found under stones, and decayed wood and leaves, and also in brooks and pools. Holbrook observed them swimming with vivacity under ice an inch thick. Storer found fragments of *Lymnaea*, *Physa*, insects, and spiders in their stomachs, and also ascertained that they cast their skin in June, and that the new cuticle was in every respect similar to the old. They are not so rapid in their motions as *Plethodon erythronotus*. In confinement they thrive well if allowed a daily supply of fresh water and a sufficient quantity of flies, which they seized by a sudden spring, and swallowed apparently by several continued efforts. Their eggs are laid attached to weeds and grass in shallow water, in albuminous masses, looking somewhat like those of frogs, and the young does not lose its branchiae until late in development.

Mr. Howard A. Kelly* relates that he has taken the "Red Eft," *Notophthalmus miniatus*, found in Sullivan County, Pennsylvania, and kept them in a dark box filled with moss and saturated with water; and that all the specimens thus treated changed from the vermilion of the *miniatus* to the dull or olive of the *Notophthalmus viridescens*, that upon being thrown into water they struggled to land, but soon returned to the water, coming to the surface at intervals for air. They were kept for sometime and always appeared satisfied with their aquatic residence. Such an observation would seem to indicate that instead of specific or even varietal differences in this species, we have simply the changes due to age and condition.

*Am. Naturalist, Vol. xii, p. 399.

FABULAR LIST OF THE REPTILIA AND AMPHIBIA OF OHIO.

The following list of nomenclature is subjoined, believing that it will be convenient for reference.

REPTILIA.

LACERTILIA.

SCINCIDÆ.

Eumeces fasciatus, Linn. Blue-tailed Skink.

Lygosoma laterale, Say. Ground Lizard.

IGUANIDÆ.

Sceloporus undulatus, Harlan. Brown Swift.

OPIHIDIA.

CROTALIDÆ.

Crotalus durissus, Linn. Banded Rattlesnake.

Crotalophorus tergeminus, Holb. Prairie Rattlesnake.

Crotalophorus tergeminus var. *kirtlandii*. Massassauga.

Ancistrodon contortrix, Linn. Copperhead.

COLUBRIDÆ.

Eutania saurita, Linn. Ribbon Snake.

Eutania proxima, Say. Say's Garter Snake.

Eutania sirtalis, Linn. Garter Snake.

Eutania sirtalis, var. *dorsalis*, Baird and Girard.

Regina leberis, Linn. Leather Snake.

Regina kirtlandii, Kenn. Little Red Snake.

Tropidonotus sipedon, Linn. Water Snake.

Tropidonotus erythrogaster, Shaw. Red-bellied Water Snake.

Heterodon platyrhinus, Latr. Hog-nose Snake.

Heterodon platyrhinus, var. *niger*, Cat. Black Viper.

Ptyophis melanoleucus, Daud. Bull Snake.

Ophibolus calligaster, Say. Say's Chain Snake.

Ophibolus triangulus, Boie. Milk Snake.

Ophibolus doliaatus, Linn. Red Snake.

Coluber obsoletus, Say. Pilot Black Snake.

Bascanion constrictor, Linn. Blue Racer.

Liopeltis vernalis, DeKay. Green Snake.

Cyclophis æstivus, Linn. Summer Green Snake.

Diadophis punctatus, Linn. Ring-necked Snake.

Diadophis punctatus, var. *amabilis*, Baird and Girard.

Storeria dekayi, Holb. Little Brown Snake.

Storeria occipito-maculata, Storer. Red-bellied Storeria.

Carphophis amœnus, Say. Ground Snake.

TESTUDINATA.

CISTUDINIDÆ.

Cistudo clausa, Gmel. Box Turtle.

CHELYDRIDÆ.

Chelydra serpentina, Linn. Snapping Turtle.

EMYDIDÆ.

Chelopus insculptus, LeConte. Sculptured Tortoise.

Nanemys guttatus, Schn. Spotted Turtle.

Graptemys geographica, LeSueur. Map Turtle.

Graptemys lesueurii, Gray. LeSueur's Map Turtle.

Chrysemys picta, Herm. Painted Turtle.

Chrysemys marginata, Ag. Lady Turtle.

Cinosternum pennsylvanicum, Bosc. Mud Tortoise.

Aromochelys odoratus, Latr. Musk Tortoise.

Amyda mullica, LeSueur. Leathery Turtle.

Aspiderochelys spinifer, LeSueur. Soft-shelled Turtle.

AMPHIBIA.

ANOURA.

BUFONIDÆ.

Bufo lentiginosus, var. *americanus*. American Toad.

HYLIDÆ.

Chorophilus triseriatus, Wied. Little Tree Frog.

Acris gryllus, var. *crepitans*, Baird. Cricket Frog.

Hyla versicolor, LeConte. Common Tree Toad.

RANIDÆ.

Rana halerina, Kalm. Leopard Frog.

Rana palustris, LeConte. Marsh Frog.

Rana temporaria, var. *sylvatica*, LeConte. Wood Frog.

Rana clamitans, Daud. Green Frog.

Rana catesbeiana, Shaw. Bull Frog.

URODELA.

PROTEIDÆ.

Menobranchius lateralis, Say. Mud Puppy.

MENOPOMIDÆ.

Menopoma alleghaniensis, Harl. Hell-bender.

SALAMANDRIDÆ.

Amblystoma punctatum, Linn. Large Spotted Salamander.

Amblystoma opacum, Grav. Blotched Salamander.

Amblystoma tigrinum, Green. Tiger Salamander.

Amblystoma jeffersonianum, Green. Granulated Salamander.

Amblystoma microstomum, Cope. Small-mouthed Salamander.
Amblystoma zippias, Cope. Long-tailed Salamander.
Plethodon erythronotus, Green. Red-backed Salamander.
Plethodon glutinosus, Green. Gray-spotted Salamander.
Plethodon fuscus, Raf. Dusky Salamander.
Spelerpes bilineatus, Green. Striped-back Salamander.
Spelerpes longi caudus, Green. Cave Salamander.
Spelerpes ruber, Daud. Red Salamander.
Spelerpes porphyriticus, Green. Salmon-colored Salamander.
Notophthalmus viridescens, Raf. Crimson Triton.

Species doubtfully referred to Ohio :

OPHIDIA.

CROTALIDÆ.

Crotalophorus miliaris, Linn.

COLUMBIDÆ.

Regina grahamii, Baird and Girard. Graham's Snake.
Tropidonotus fasciatus, Linn.
Tropidonotus rhombifer, Hol. Holbrook's Water Snake.
Coluber vulpinus, Baird and Girard. Fox Snake.

TESTUDINATA.

EMYDIDÆ.

Emys melegris, Shaw. Blanding's Box Tortoise.

AMPHIBIA.

ANOURA.

HYLIDÆ.

Chorophilus nigrinus, LeConte.
Hyla pickeringii, Holb. Pickering's Tree Toad.

URODELA.

SALAMANDRIDÆ.

Hemidactylium scutatum, Schl. Four-toed Salamander.

Whole number of species reported from the State :

<i>Amphibia</i>	5
Ophidia	23
Testudinata	11
Anoura	9
Urodela	16
Total	62

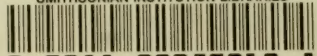
Number of species doubtfully referred to Ohio :

Ophidia	5
Testudinata	1
Urodela	1
Total	9



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